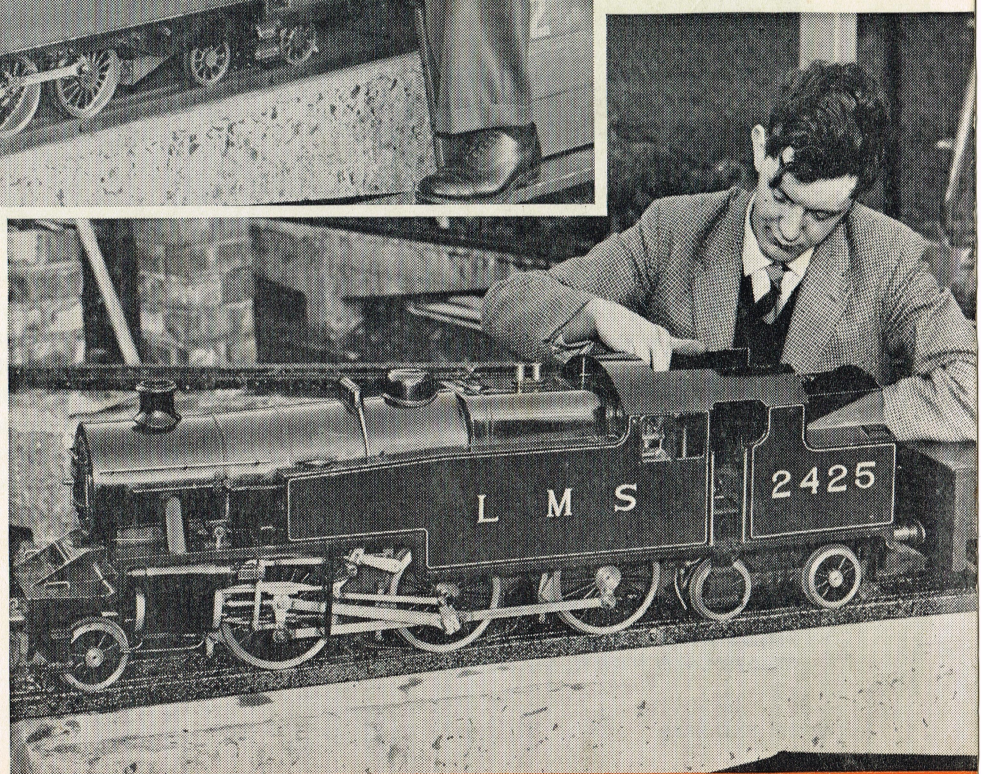
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

DOWN THE SCALES

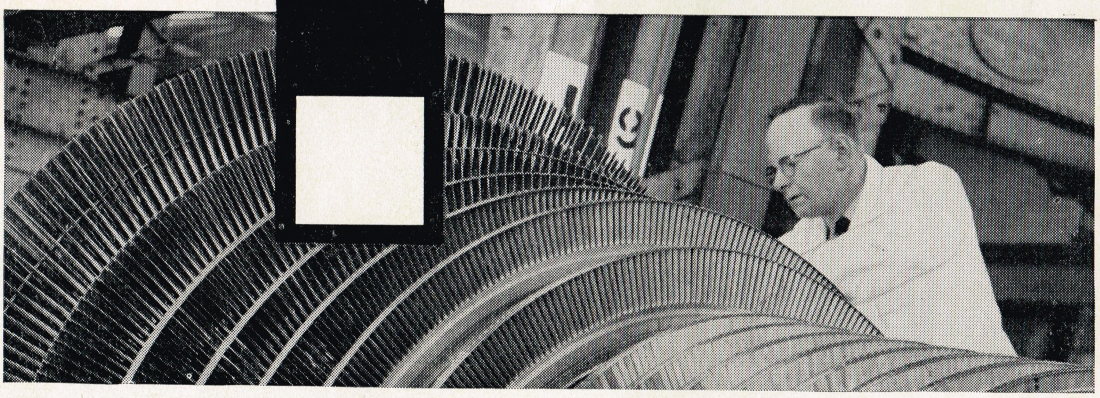
British Railways driver turns to models



- Birmingham steam weekend
- Locomotives I have known
- My garden railway

ONE SHILLING 4 MAY 1961 VOL 124 NO 3121

Does this seem familiar



Part of the blading of a modern 30,000 kW turbine generator built by AEI for an overseas power station. AEI's activities cover every side of electrical engineering.

SOME AEI TRAINING COURSES AT MANCHESTER:

(For Public, Grammar and Technical School leavers). Student Apprenticeship Sandwich Course · Technician and Drawing Office Apprenticeships · Craft Apprenticeship · Industrial Accountancy and Commercial Traineeships.

If this seemed familiar—even if you were interested in discovering exactly what it means—you probably have that burning interest in practical things which can lead to a career with AEI. Natural ability, a keenness to share in tomorrow's achievements and a good academic record are the qualifications required. You should find out more about the engineering opportunities with AEI.

WRITE TO: **THE MANAGER, EDUCATION DEPARTMENT**
Associated Electrical Industries (Manchester) Limited
TRAFFORD PARK, MANCHESTER 17

AEI

A/AI01

Reeves Castings

with *THAT "SOMETHING EXTRA"*

"ROB ROY" CALEDONIAN

0-6-0 TANK LOCO FOR 3½ in. GAUGE

Designed by Martin Evans

Blueprints, per sheet	4/6
,, per set	22/6
Frame steel	6/6
Buffer beam angle	2/10
Main horns, hot pressed	10/6 set
Main axleboxes	11/3 set
Drivers in superlative soft grey iron, per set	15/-
Valve gear ecc. straps	5/-
Dome	4/-
Door and ring	9/-
Cylinder castings	45/-
Chimney, available later.	

Postage extra

A 1/- stamp will bring you a copy of our latest lists of blueprints and castings for many small steam locomotives —stationary engines, workshop equipment, etc.

"THE CHOICE OF EXPERIENCE"

A. J. REEVES & CO. (BIRMINGHAM) LTD.,

416, MOSELEY ROAD, BIRMINGHAM 12

Telephone: CALthorpe 2554.

BOND'S

are pleased to announce that

THE BOND'S 'MAXIMUS' BENCH MILLING MACHINE

is now available again.

Principal dimensions: Overall, main body, 19" x 21½" x 19½" high. Table 14" long x 5" wide. Table traverse 10½" long, 4" cross. Table rise and fall 7". Cone pulley, 3-speed, 5", 4" and 3" dia. for 1" flat belt. Weight 102 lb. Complete with cutter arbor and collars for ½" dia. hole cutters. Spindle bored No. 2 M.T. and ⅝" through.

Price £58

3-speed cone pulley, ½" bore, for use in countershaft, £3/19/6.

Carr. and packing extra.

Further particulars on application.

Bond's Model catalogue, price 2/-.

Bond's list of stock gears, price 3d.

Bond's catalogue of steam fittings, tools and materials—new list in course of preparation.

BOND'S O'EUSTON ROAD LIMITED

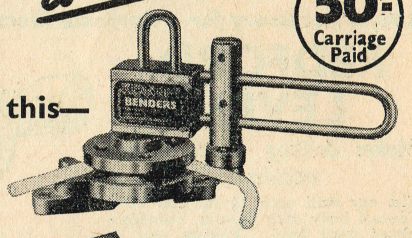
357 EUSTON ROAD, LONDON N.W.1.

Est. 1887 *Phone EUSton 5441-2*

A model to make— a tool to use!

50/- Carriage Paid

Make this—

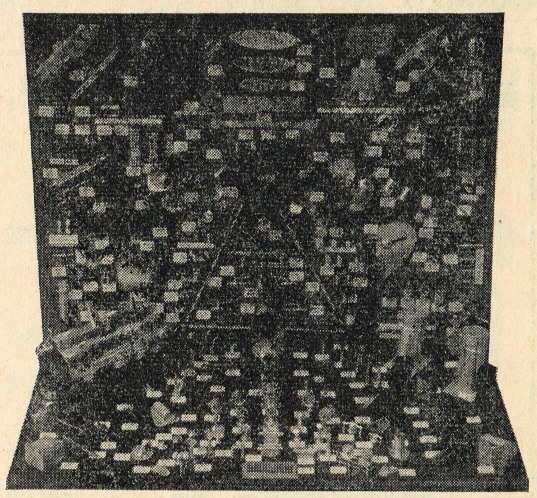


—with the KENNEDY MODEL MAKER'S KIT

The Kennedy No. 0 Universal Bending machine is yours for the making! With it you can accurately and rapidly bend, to precise measurement, steel and non-ferrous tubes, angles, tees, strips (on edge or flat), channels or other sections. It is an indispensable workshop tool for model makers, metal handicrafts and engineering students. *Full details from:—*

W. KENNEDY LTD., WEST DRAYTON, MIDDX.

Tel.: West Drayton 2084.



Our new Illustrated Catalogue, with 8 page supplement of latest Fittings, now 56 pages, is available Price 4/-

A general survey of a few of over 1,300 size fittings made in our works. Whether you require fittings for Yachts, Sailing Ships, Launch, Liner, Naval or Marine our excellent products will give you entire satisfaction, at a reasonable price. Send your order direct to our works for satisfactory service if difficult to obtain. We regret NO ENQUIRIES can be answered unless a stamp is enclosed for return postage.

THE WEB MODEL FITTING CO.

204 (E) HIGH ROAD, LONDON, N.22

If it's a Web model, it's good

THE SIGN OF QUALITY

GAMAGES

FOR TOOL VALUES THAT CAN'T BE BEATEN

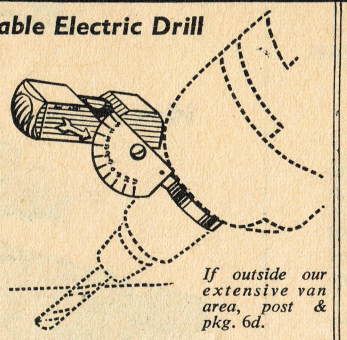
Useful Accessory for a Portable Electric Drill

REDFORD LEVEL

Makes drilling much more accurate

Fits any drill with 1½ in. dia. boss. Die-cast body with built-in, cadmium-plated spirit level. Enables user to drill from horizontal position downwards to vertical and upwards to 45° in 15 graduations.

BARGAIN PRICE 6/6



If outside our extensive van area, post & pkg. 6d.

Special Bargain Offer!

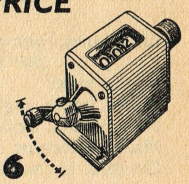
STROKE COUNTERS

at LESS than HALF PRICE

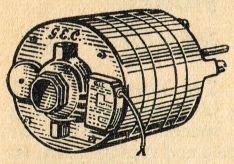
Reading from 0 to 999 and can be quickly reset to Zero. The striker arm has a roller fitted to eliminate wear. Quick, easy operation. A 1½ in. × 1 in. Flat Base allows for simple fixing to almost any machine. Overall size 2¼ in. long × 1¼ in. high × 1 in. wide.

To-day's Value 33/6.

GAMAGES PRICE 12/6



If outside our van area Post and Pkg. 9d. (two for 1/3)



SENSATIONAL OFFER OF GEC ¼ h.p. ELECTRIC MOTORS

G.E.C.

BARGAIN OFFER! ELECTRIC MOTORS

Worth More Than Double!

Made by the world-famous General Electric Company —a guarantee of quality. BRAND NEW. Continuous rated. For 230/250 Volts, 1,440 r.p.m. A.C. Split Phase start induction Type. 2 in. × ½ in. dia. Spindle. Can be operated in vertical position too. Dia. 6 in.

GAMAGES BARGAIN PRICE 79/6

If outside our van area Carr. & Pkg. 7/6.

Useful in Every Workshop

DRILL GRINDING JIGS

Capacity ⅛ in. to ¾ in.

Results equal to original pointing by manufacturer. Has scale of five angles: 88° for thin sheet, hard materials and counter-sinking. 68° for ¼ in. drills and smaller. 59° for general purposes. 49° for very soft materials. 30° for drilling wood, ebonite and formica.

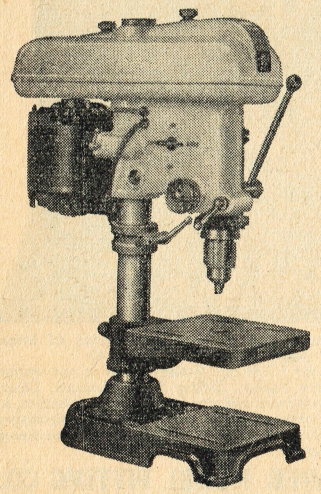
GAMAGES PRICE 42/-

If outside our van area Post & Pkg. 1/9.

GAMAGES, HOLBORN, E.C.1 *HOL 8484* **Tool & Car Accessory List Free**

BUCK & RYAN Ltd.

TOOL MERCHANTS



FOBCO DRILLING MACHINE

0-½" capacity

For 220/240 £42·18·6

For 400/440 £40·11·0

Mortising Attachment £6·13·6

Vice £4·1·6

CREDIT TERMS AVAILABLE

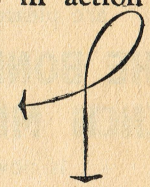
Leaflet on request

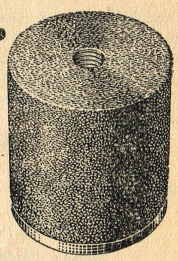
We always have in stock, a wide range of equipment for the model engineer

310-312, EUSTON ROAD, LONDON, N.W.1

Tel. EUSTON 4661

* Permanent Magnets in action *





Ever dropped a nut in a gearbox?

In case you do, have an 'Eclipse' Pot Magnet available to help you recover the nut. This is one of many ways in which magnets can help you.

Ask your tool dealer for descriptive literature.

Eclipse

POT MAGNET 831A 3/3 each
832B 4/- ,,
833C 6/3 ,,

PERMANENT MAGNETS

Made by James Neill & Company (Sheffield) Limited

are obtainable from all tool distributors

PM42

Model Engineer

Incorporating Mechanics (Home Mechanics and English Mechanics) and Ships and Ship Models

IN THIS ISSUE

Smoke Rings 537
Midland museum to have Hall of Locomotives 539
Three Canadian models 541
Be-a-Judge Competition 543
Workshop hints ... 545
My garden track in Sussex 546
Watt was proud of his parallel motion ... 549
Locomotives I have known—Kirtley's Ms of the SECR 552
Hielan' Lassie 554
Favoured in France ... 556
Firefly—Brake gear and pony truck for the 3½ in. gauge model 559
Readers' queries ... 562
Postbag 564
Simple steam tug at Silver Springs 567
Club news... 568

COVER PICTURE

Two 5 in. gauge tank locomotives which, in company with others, often head the Albert Park Express, Middlesbrough. The miniature line is operated by the local locomotive club. The 'Jubilee', built by Mr John Heslop, of Thirsk, is well known to 'Model Engineer' readers.

ONE SHILLING · 4 MAY 1961

VOL 124 · NO 3121

Published every Thursday Subscription 65s. (USA and Canada $9.25), post free

The Editor is pleased to consider contributions for publication in MODEL ENGINEER. Manuscripts should be accompanied by photographs and/or drawings and should have a stamped addressed envelope for their return if unsuitable. None of the contents of MODEL ENGINEER may be reproduced without written permission.

© Percival Marshall & Co. Ltd, 1961

19/20 Noel Street, London W1.
GERrard 8811

A WEEKLY COMMENTARY

Smoke Rings

By VULCAN

IF your society is short of members the secretary might do worse than adopt the tactics of a young lad in the Ipswich and District SMEE, who wrote to the local paper.

"Within two or three days," writes Mr C. G. Foreman, secretary of the society, "a reporter and photographer arrived. A picture was duly published. The following week back came the photographer to do a series of pictures on the club's models and activities."

This apparently caught the eye of a television agent who visited the club with the happy result that the Ipswich society received some publicity on the East Anglian services of the BBC and ITV.

And still new shoots kept starting. Anglia Television then sent an invitation to Mr Foreman to come to the studio. Naturally, he accepted and an interview conducted by Miss Val Pitts was broadcast in the "About Anglia" programme transmitted on April 5.

Tall oaks from little acorns grow....

Boiler certificate

IN the issue of April 20 we published details of the procedure adopted by the Pennsylvania Live Steamers, one of the foremost clubs in the United States, in regard to boiler tests.

When a locomotive has passed the test the owner is issued with a certificate. There must be many club officials who would be interested in the data which the Americans include on the certificate, and the manner in which the facts are displayed, and for their benefit I have reproduced it on this page.

Though the original is a duplicated effort, it is abundantly clear and includes all the necessary information.

PENNSYLVANIA LIVE STEAMERS

BOILER INSPECTION CERTIFICATE

Valid for one (1) year from date of issue.

Date_____196__ Time_____ AM PM Fuel_____

Working Pressure_____ Hydro Test Pressure_____

Safety Valve Steam Test Valve No.1_____PSI

Valve No.2_____PSI

Scale_____ Type_____ Year completed_____

Gauge_____ Engine No._____ Blr. Matl._____

Owner_____

Residence_____

Test Certified By_____

NOTE:

1. This is a reproduction of the 3" x 5" plain cards that are printed on white and yellow (with the PLS postcard printer).
2. White card is retained by Boiler Inspector and/or Secretary.
3. Yellow card is retained by engine owner or operator.
4. "Boiler Inspection Certificate" to be available on demand of Boiler Inspector or club official when engine is operated on home track or when visiting other clubs.

Now freelancing

THE Imperial War Museum, research centre for the serious ship modeller, is in the throes of a rebuilding programme and as a consequence the model making shop has been closed.

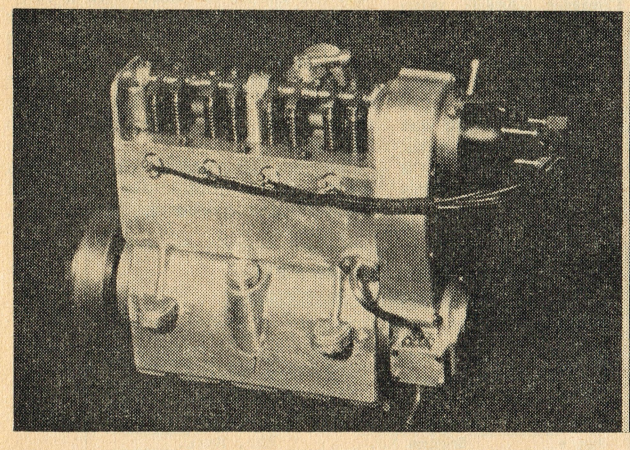
The closure, I am told, is only temporary, but for the time being Mr Arthur D. Trollope and Mr J. P. Glossop, many of whose fine models are exhibited in the galleries, are no longer working at the museum.

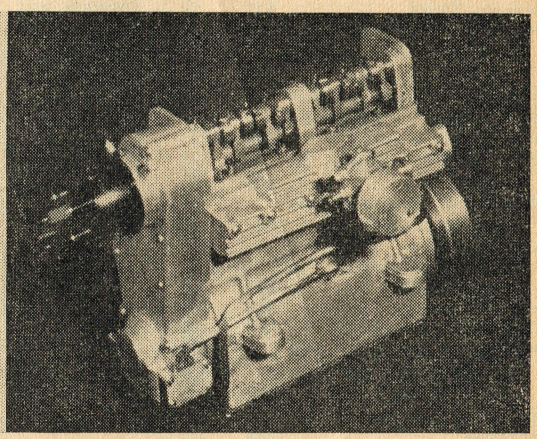
But—cheerful note—these two distinguished modellers are not lost to the hobby; they will continue their work on a freelance basis, Mr Trollope at his home address and Mr Glossop on Admiralty premises.

Beginner's Sealion

THE advice generally given to beginners, that they should make a start with simple models well within their capacity, is undoubtedly sound, but there are occasions when the results obtained by beginners in the construction of complicated models astound experienced hands.

An instance of this is the achievement of Mr S. A. Dove, of Hounslow, in building the 30 c.c. Sealion four-cylinder petrol engine illustrated,





Two views of the 30 *c.c. Sealion, a very fine first attempt by Mr S. A. Dove, of Hounslow, London*

which has been made to the ME design.

He writes: " Please don't ask me what possessed me to tackle this model, as I had never done any lathe work in my life before. But . . . it does prove that with the necessary tools, patience and initiative, most things *can* be done. This engine presented me with many problems, but also lots of interest, and the results have been very satisfactory, as it started when set up for the first time."

Mr Dove has promised some further photographs of the engine, and I hope that these will be accompanied by an account of his experiences in constructing it.

Example is always better than precept, and the successful outcome of this kind should be a great encouragement to the many inexperienced readers who lack confidence in their ability to construct some of the models described in this journal.

Details wanted

FROM across the wide Atlantic comes praise for Martin Evans' book *A Manual of Model Steam Locomotive Construction.*

Mr James E. Todd, of Painesville, Ohio, who is just tightening the final nuts on his 1½ in. scale *Royal Scot*, reckons that the fine illustration of Mr Buist's GN Stirling in ¾ in. scale was alone worth the speculation of his 30s.

His next project is to be a GN Stirling, to double the scale of Mr Buist's, and he would like information, with a loan of plans if possible, from anyone who has built such a model. In fact, I think he would welcome details from anyone who has made a Stirling in any size. We have already put him in touch with Mr Buist.

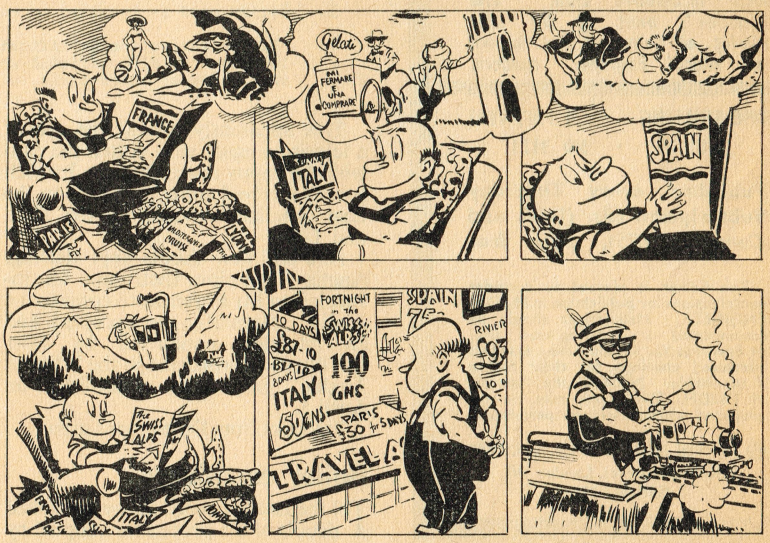
I think readers would like to hear about the 7¼ in. gauge *Royal Scot*. How about a few notes, Mr Todd ?

Mr Todd's residence in Painesville is 477 Owego Street.

Next week

Ship modellers who are entering the Canberra competition must not miss MODEL ENGINEER *for May* 11. *It will contain an article by Mr Edward Bowness on some of the tricky problems which constructors have met. In next week's issue also will be the third part of the new Be-a-Judge Competition.*

CHUCK . . . . . . THE MUDDLE ENGINEER



MIDLAND MUSEUM to have HALL OF LOCOMOTIVES

W. J. HUGHES reports on a live steam weekend at one of the most interesting places in Birmingham

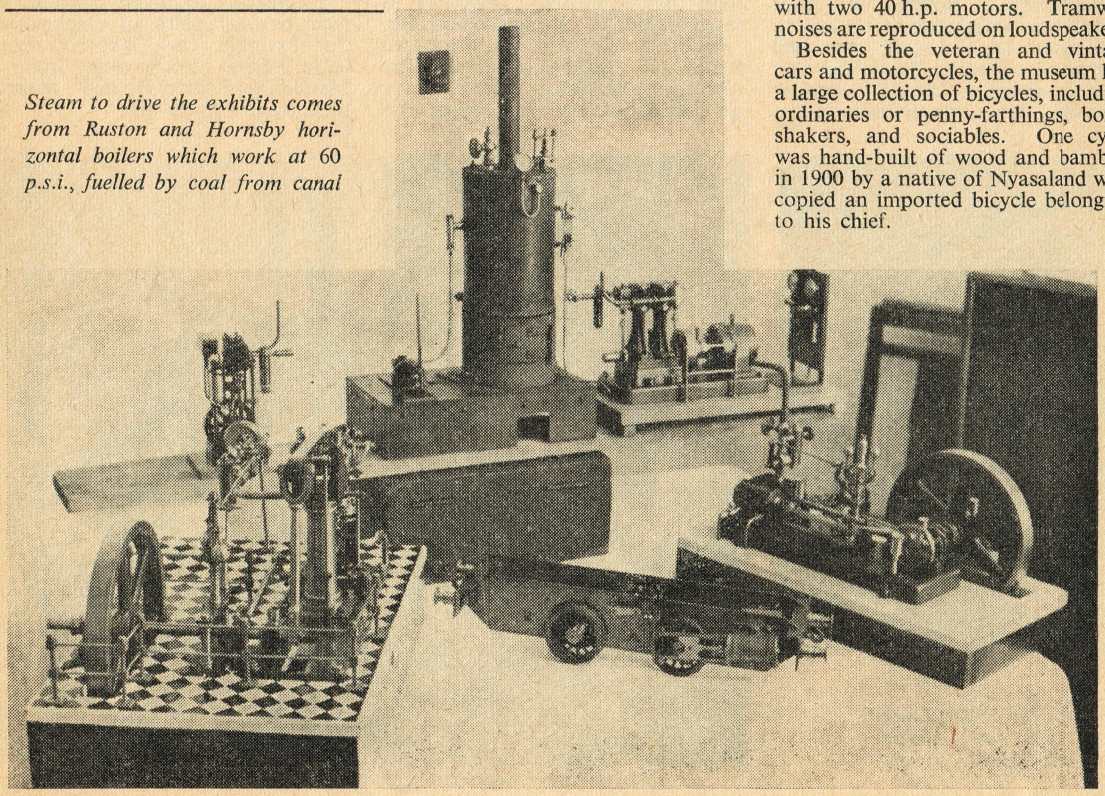
BIRMINGHAM Science Museum's live steam weekend had the usual engines in steam. They were, of course, the principal attraction.

When we have admired the steady gait of the beam engine, the pulsing rhythm of the small Tangye horizontal engine, the steady tick-over of the Aveling and Porter steam-roller and the Ruston Procter portable—when we have enjoyed watching all the engines in motion, there are still plenty of other things to see. The number is growing constantly as more of the buildings on the site are rebuilt or reconditioned. A project for the not-too-distant future is a Locomotive Hall. Here one of the exhibits will be the BR *City of Birmingham*, and another, a Peckett industrial tank engine, at present in store.

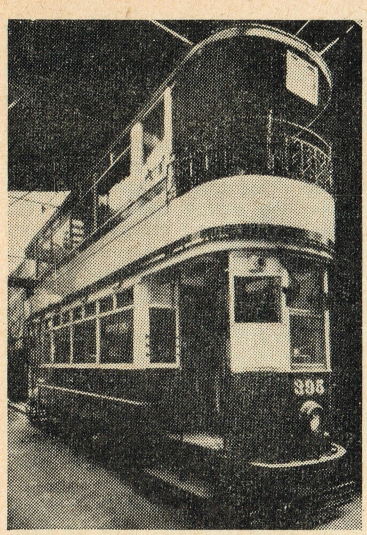
Presumably they will be joined by the small *Secundus*, now on show in an alcove. She was built by Belliss and Seeking (later Belliss and Morcom) in 1874, and she worked on the 2 ft 8½ in. gauge Furzebrook Tramway in Dorset. Her features include a marine-type firebox, and Stephenson valve-gear outside the motion.

For tramway enthusiasts the museum now has a full-size vehicle, Birmingham Corporation No 395, built in 1911-12 to 3 ft 6 in. gauge, with two 40 h.p. motors. Tramway noises are reproduced on loudspeakers.

Besides the veteran and vintage cars and motorcycles, the museum has a large collection of bicycles, including ordinaries or penny-farthings, boneshakers, and sociables. One cycle was hand-built of wood and bamboo in 1900 by a native of Nyasaland who copied an imported bicycle belonging to his chief.

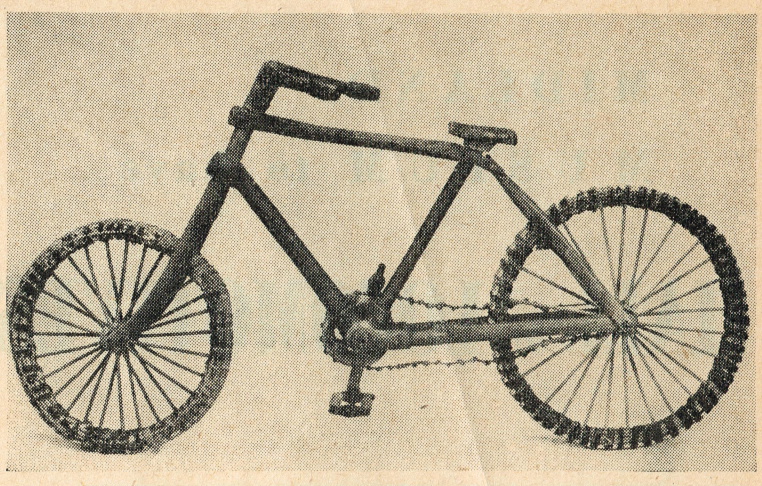


Steam to drive the exhibits comes from Ruston and Hornsby horizontal boilers which work at 60 p.s.i., fuelled by coal from canal



Copyright City Museum and Art Gallery, Birmingham

Birmingham Corporation tramcar No 395 can be seen in the transport section



Copyright City Museum and Art Gallery, Birmingham

This bicycle of wood and bamboo was made in 1900 by a native of Nyasaland

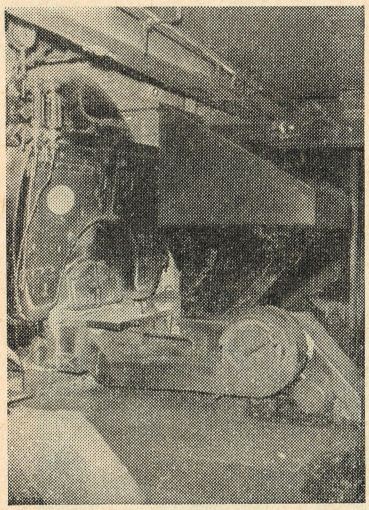
Upstairs in a corridor is a very fine model of a Watt rotative engine built at Soho in 1788 and used to drive polishing machines at the Soho Manufactory of Boulton and Watt and to show prospective engine-buyers. The model has a timber beam and frame and, of course, Watt's Sun-and-Planet motion. Separate wooden cogs are fitted into sockets in the flywheel rim, for driving machinery.

In the same corridor is a set of original framed drawings, coloured and beautifully shaded, of individual components for a large beam engine.

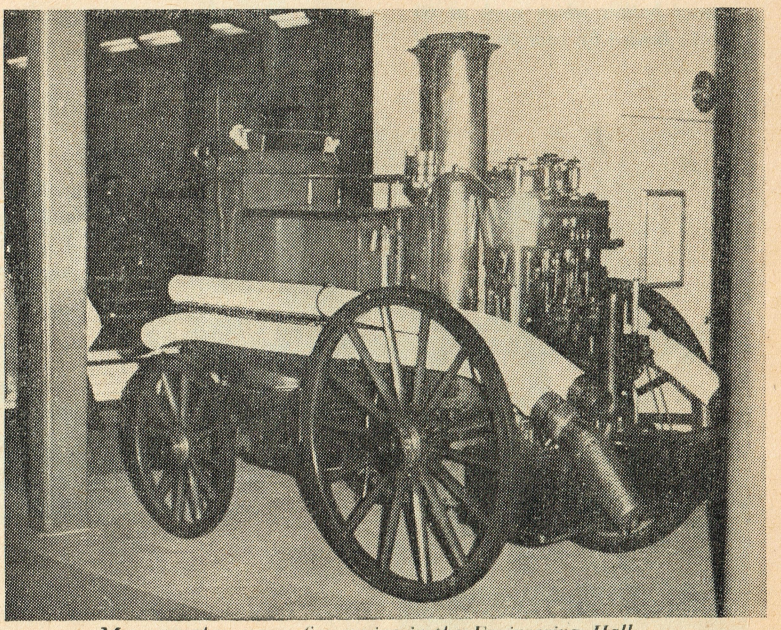
The Arms Gallery contains hundreds of examples of craftsmanship in weapons of all kinds. Close at hand are replicas of workshops with original tools and equipment, belonging to seven traditional Birmingham trades.

In the boiler-house I saw the two Ruston and Hornsby horizontal boilers with their mechanical stokers. They were installed in 1937, when the premises were still an electro-plate factory—they work at 60 p.s.i. One alone will supply easily all the steam needed to heat the museum and drive the engines. Coal is brought in by barge, for—as the museum lies athwart the Birmingham and Fazely Canal, a full-sized working canal lock is one of its permanent exhibits.

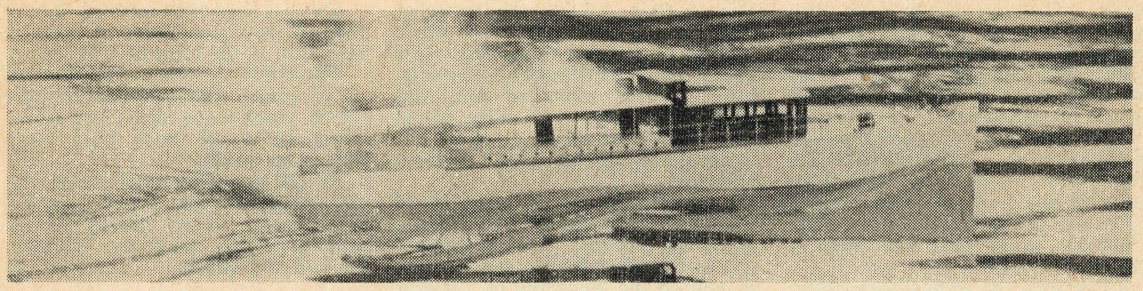
Technicians dismantle machines at their original place of employment (for example, the Galloway drop-valve engine which came from a Macclesfield factory) and re-erect them at the museum. ▣



Down in the boiler house stand the two boilers with mechanical stokers

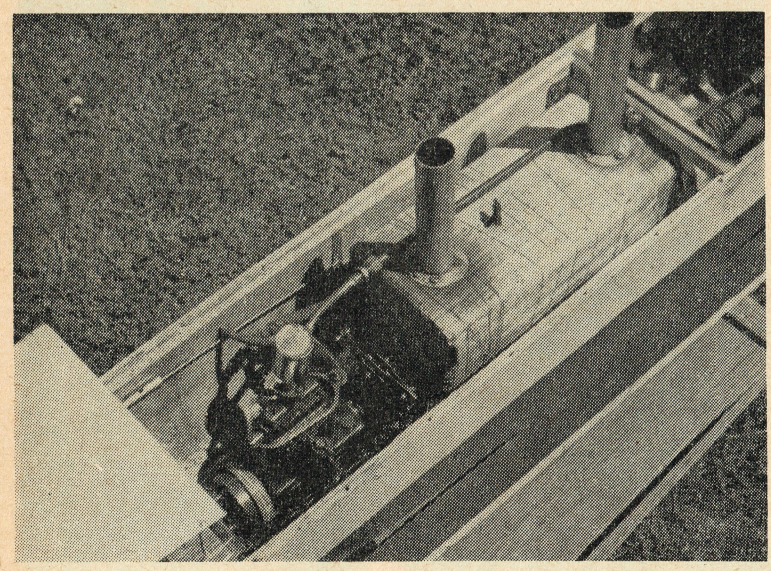


Merryweather steam fire engine in the Engineering Hall



Three Canadian models

H. A. WEBSTER thinks that beginners may be interested in the steam boats which he has built from scrap metal

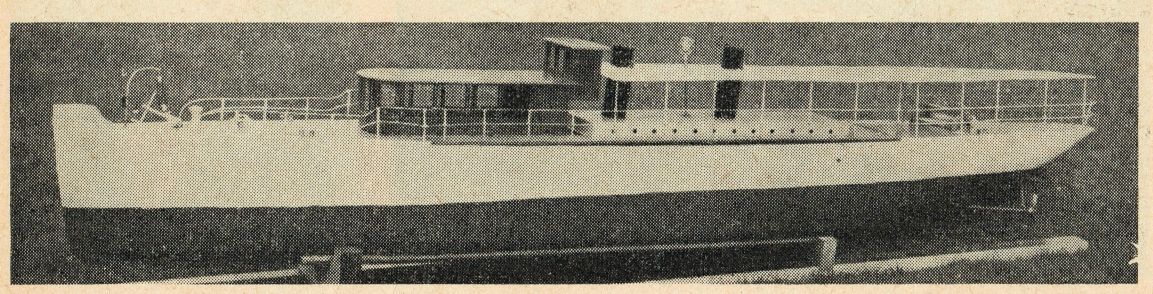


WHILE my models would not shine at a Model Engineer Exhibition, some beginners may find something of interest in them. My latest is of a lake or river craft, 5 in. long, 7 in. beam and about 30 lb. displacement.

It came to be constructed as the result of my picking up at a local scrap metal merchants a small brass boiler, a Sun engine, and a gearbox which had been thrown away.

The hull is of four planks of rough cedar, quite common in British Columbia. After planing them up, I fastened them together with three 5 in. screws and two oak dowels. The solid block weighed over 40 lb. I shaped the hull in the usual way, using templates. The dowels were withdrawn, the screws were taken out, and the centre part of the three upper planks was removed with a home-made bow saw.

Most of the lower plank was gouged



away. The four planks were then glued with waterproof glue and the inside was reduced to about $\frac{3}{8}$ in. with a sharp gouge. The hull then weighed about 5 lb. I made the saloon of mahogany.

When I bought the plant it was in poor condition. The boiler lacked a feed pump, which I felt should be installed, and the furnace tube was only $1\frac{3}{8}$ in. dia. in a 4 in. barrel 11 in. long. Four $\frac{3}{8}$ in. cross tubes were fitted in the furnace tube.

I discarded the vertical superheater placed at the end of the boiler, and fitted one similar to that in the ME Trident boiler. Then I mounted the boiler in a rectangular casing, allowing the hot gases to escape up the funnels at a position midway along the casing. Behind the boiler is the small rocking shaft that operates the pump, $\frac{3}{16}$ in. dia. and $\frac{1}{2}$ in. stroke.

The Sun engine drives twin propellers of $2\frac{1}{2}$ in. dia. through a spur gearbox. All the driving mechanism is mounted on a length of band steel $\frac{1}{8}$ in. thick and $2\frac{1}{2}$ in. in width. This greatly facilitates the removal for adjustments.

The boat has operated for 35 min. without attention.

I built up the cargo ship on the same lines. It is 48 in. long and is driven by a Stuart 10 which I made from castings. The boiler was constructed of 22 gauge sheet copper retrieved from an old washing machine tub. A Hooke joint was made and copper clout nails were used as rivets through the Hooke joint, which was well soldered.

The furnace tube of 2 in. dia. has six cross tubes of $\frac{3}{8}$ in. dia. silver-soldered. The safety valve is set for 50 p.s.i.

I built up a pump of $\frac{1}{8}$ in. brass material and threaded it to receive the barrel, held rigid with lock-nuts for adjustment. It is operated by an eccentric mounted on a $\frac{1}{8}$ in. shaft running in ball bearings. Spur gear reduction is $3\frac{1}{2}$: 1.

A gearbox of bevel gears was first fitted. I discarded it in favour of spur gears which take up much less room and seem to offer less friction. The gearbox reduces the propeller speed 2 : 1. I thought that a single cylinder 2 in. × $\frac{3}{4}$ in. would not handle twin $2\frac{1}{4}$ in. propellers and a feed pump, but I am now convinced that, with 60 p.s.i., a direct 1 : 1 drive would have given more speed.

The model has run 45 min. without attention.

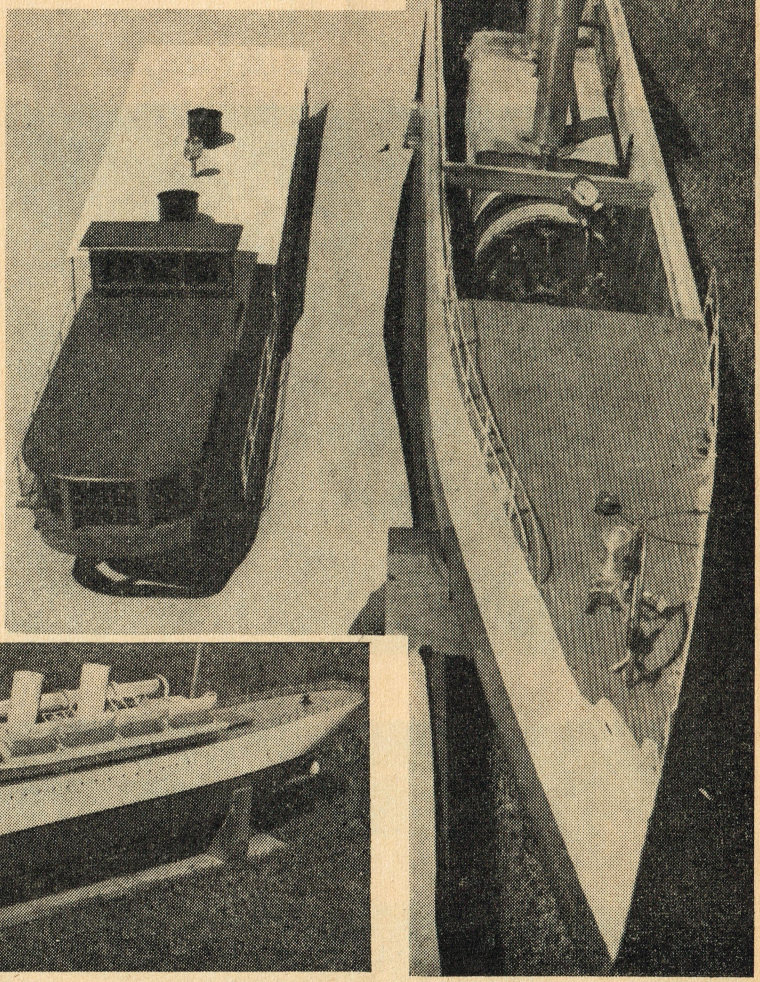
I am amazed at the amount of water which a pump of $\frac{3}{16}$ in. × $\frac{1}{2}$ in. stroke can displace. The $\frac{1}{4}$ in. plunger had to be changed for a smaller one. It pumped the boiler full on the first run. Both boilers are fired by home-made blowlamps.

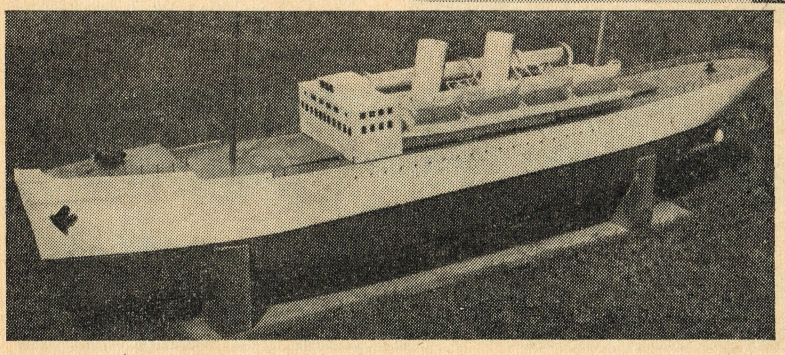
My Maxim tug, built some years ago, has a $\frac{3}{4}$ in. × $\frac{3}{4}$ in. cylinder engine built up of scrap. The original pot boiler has just been replaced with a boiler similar to the one in the cargo ship. For the shell I used more old washing machine tub. The ends are $\frac{1}{8}$ in. old pipe cut lengthwise and flattened. A 2 in. furnace tube has six $\frac{3}{8}$ in. tubes.

This has since been rectified. I have fitted a new superheater of stainless steel bent in the form of a flat spiral.

The safety valve is set to blow off at 45 p.s.i. Fittings include water gauge, check valve, and globe screw-down valve, all made from scrap picked up locally.

For the superstructure I used biscuit tins opened flat and placed around a wood form. Deck fittings include steering wheel, telegraph, binnacle, capstan and winch. ▣





Be-a-Judge Competition

WIN A MYFORD SUPER 7 LATHE IN THIS BE-A-JUDGE COMPETITION

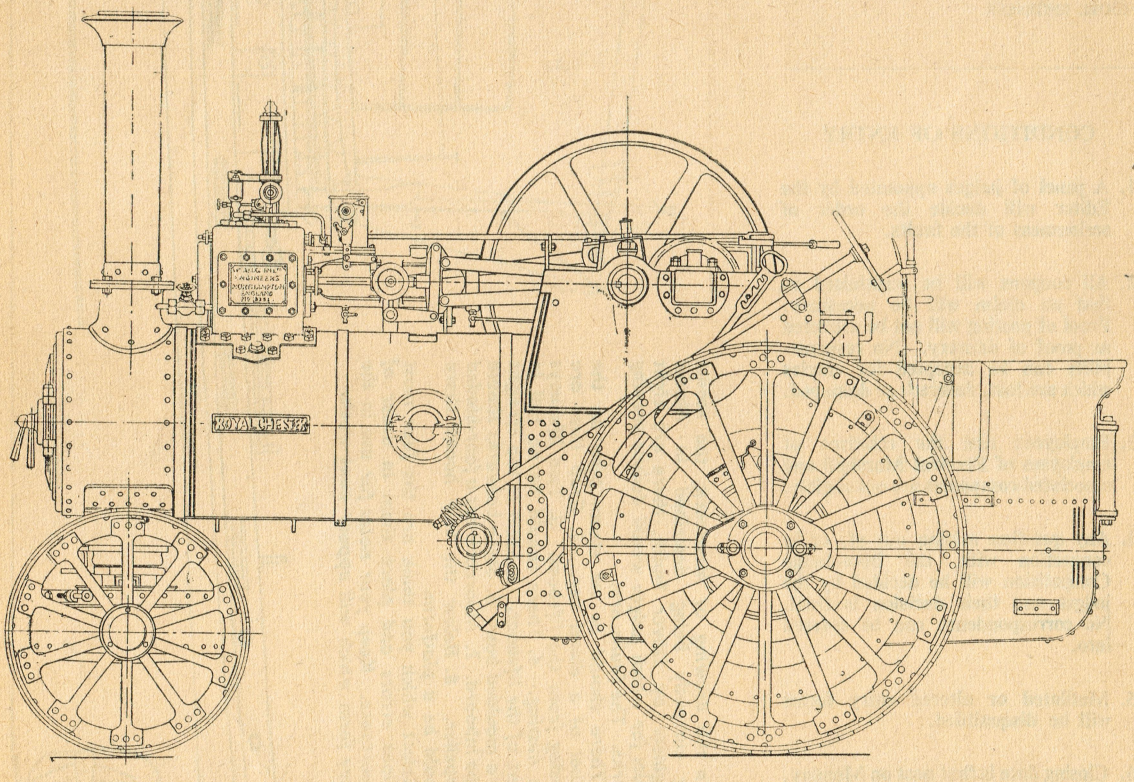
Runners-up will receive a high-quality bench drill and bottled gas equipment

PRIZES WORTH £150

PART TWO

THIS week we come to the second part of the grand Be-a-Judge Competition, which offers every reader an opportunity to test his, or her, skill as an exhibition judge.

The idea is to decide from the accompanying drawings, each of which illustrates eight faults, what you think are the four most serious errors in



In this drawing of the Allchin traction engine there are eight faults for which judges would deduct varying marks. The faults are:

1. Weights are missing from the governor. 2. Steering chains have been forgotten. 3. Flywheel is on the wrong side. 4. Chimney is too straight. 5. Spokes should not be attached to the outside of the rear wheel flanges. 6. Spokes should be attached to the inside of the front wheel flanges. 7. Safety valve is missing. 8. Drawbar has been omitted.

Select which you think are the four most serious errors and arrange them in order of importance. Keep your notes for use in the entry form which will appear next week.

each model. Place these in order of importance and keep a note of them for the entry form which will be printed next week.

In all there will be six drawings of well-known models. The first two (*Cutty Sark* and *Jubilee*) appeared in last week's Looking Ahead number, the second set is printed here, and the third and final pair will be published next week.

Today's drawings are of *Moorcock*, the model tug based on its full-size Thames big brother, and the W. J. Hughes's ME design traction engine, the Allchin.

A panel of judges representing the relevant branches of model engineering will be set up by the Editor. The competitor whose entry agrees with, or most closely approximates to, their verdict will be adjudged the winner. The three remaining prizes will be awarded to runners-up. A description of the faults is printed alongside each drawing.

Entry is free. Any number of entries may be submitted, but each must be on an official entry form from MODEL ENGINEER.

CONDITIONS OF ENTRY

1. **A panel of judges appointed by the Editor will decide the order of seriousness of the faults.**

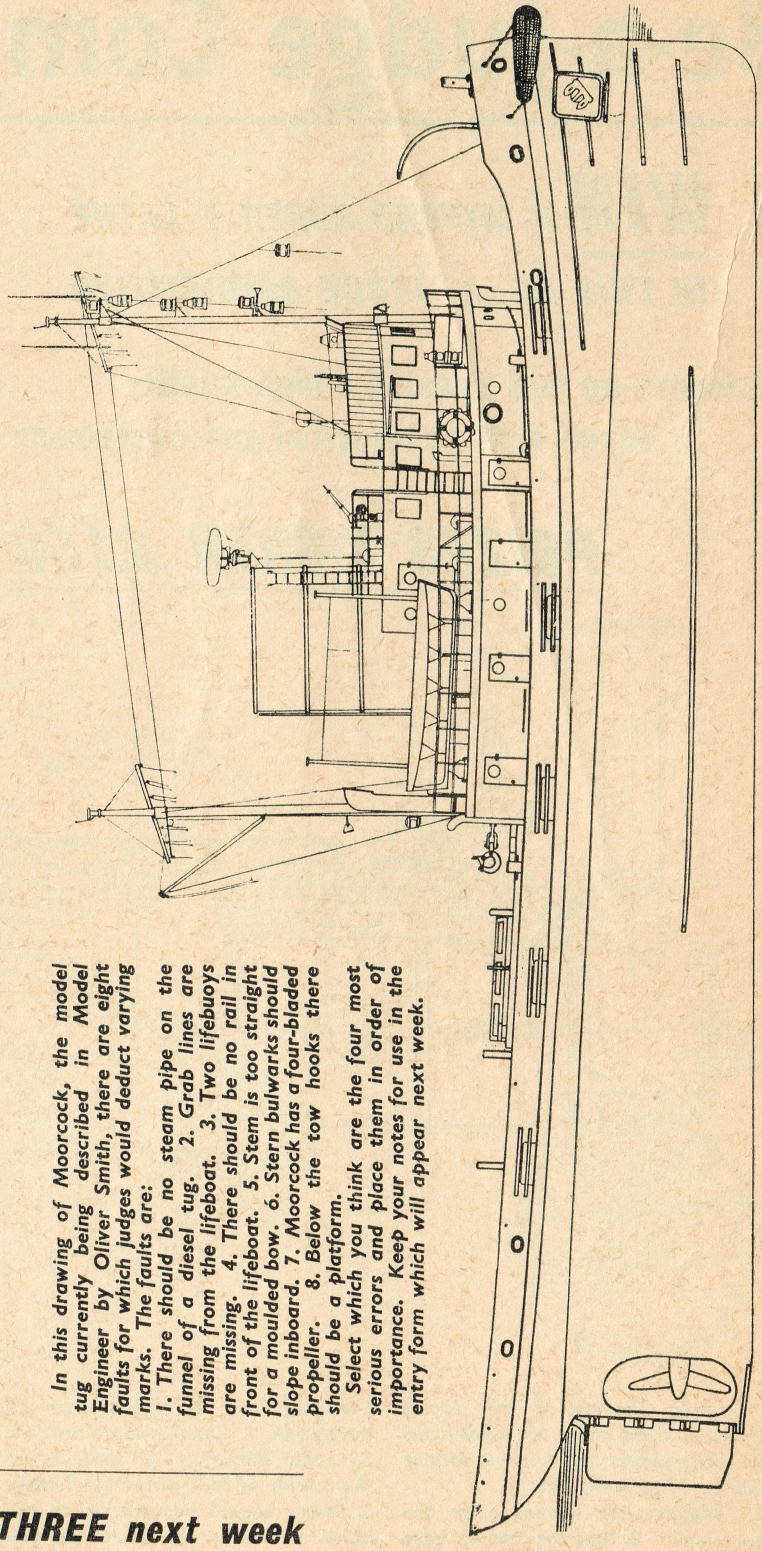
2. **All coupons will be scrutinised so that no claim will be necessary. Proof of posting will not be accepted as proof of delivery. No responsibility can be accepted for entries which are lost, delayed, or damaged.**

3. **Employees and the relatives of employees of Percival Marshall and associated companies are not eligible.**

4. **Any question arising out of, or in connection with, the Be-a-Judge Competition will be decided by the judges and their decision is final. No correspondence can be entered into.**

5. **Mutilated or altered entry forms will be disqualified.**

6. **Closing date is first post on Monday, 5 June 1961.**



In this drawing of Moorcock, the model tug currently being described in Model Engineer by Oliver Smith, there are eight faults for which judges would deduct varying marks. The faults are: 1. There should be no steam pipe on the funnel of a diesel tug. 2. Grab lines are missing from the lifeboat. 3. Two lifebuoys are missing. 4. There should be no rail in front of the lifeboat. 5. Stem is too straight for a moulded bow. 6. Stern bulwarks should slope inboard. 7. Moorcock has a four-bladed propeller. 8. Below the tow hooks there should be a platform.

Select which you think are the four most serious errors and place them in order of importance. Keep your notes for use in the entry form which will appear next week.

Watch out for PART THREE next week

ACCURATE

Centring and drilling

By *GEOMETER*

GIVEN that a centre punch dot can be located at the exact point where it is intended to be, there is every chance—even in ordinary drilling—that the resulting hole will be accurately positioned. A small well-sharpened drill can be used to provide a pilot hole from the centre punch dot; and if the required hole is large, the opening-out can be done in stages with several drills. This reduces to a minimum the chances of the hole's running.

If the job is done on the lathe, its precision depends upon the accurate setting of the centre punch dot—which is obtained by using a needle [ME, January 26, page 103], or a pointed rod and indicator [March 30, page 405]. The work can be clamped to the faceplate, or mounted on an angle plate on the faceplate, either method being suitable for obtaining the precise rise-to-centre of the angle plate.

The setting of an angle plate is, of course, particularly important, as any error is inevitably transferred to the rise-to-centre of components machined on it. Accuracy is ensured by using a centre-punched block, A, which is clamped to the front edge of the angle plate, and the centre punch dot is brought true by adjusting the angle plate on the faceplate.

For locating the centre punch dot precisely from the edge of the block, a plate is used which has a reamed or lapped hole for a short centre punch, and a stop strip is held by a toolmaker's clamp, to give the centre distance.

One way of obtaining this distance is to push the centre punch through the plate so that callipers (set from a micrometer) can be used between the punch and the stop strip—with allowance for the radius of the punch. Once this setting is obtained, the device can be laid on the block on a flat surface, and the centre punch lightly tapped. Then the block is ready for the lathe.

A development of the device consists in slotting the plate for securing and adjusting the stop strip with a countersunk screw, B. This gives the same accurate setting for locating centre punch dots from the edge of work; and a cut-away, W, which can easily be milled or filed, admits light from a torch to facilitate the sighting of spacing lines for two or more holes.

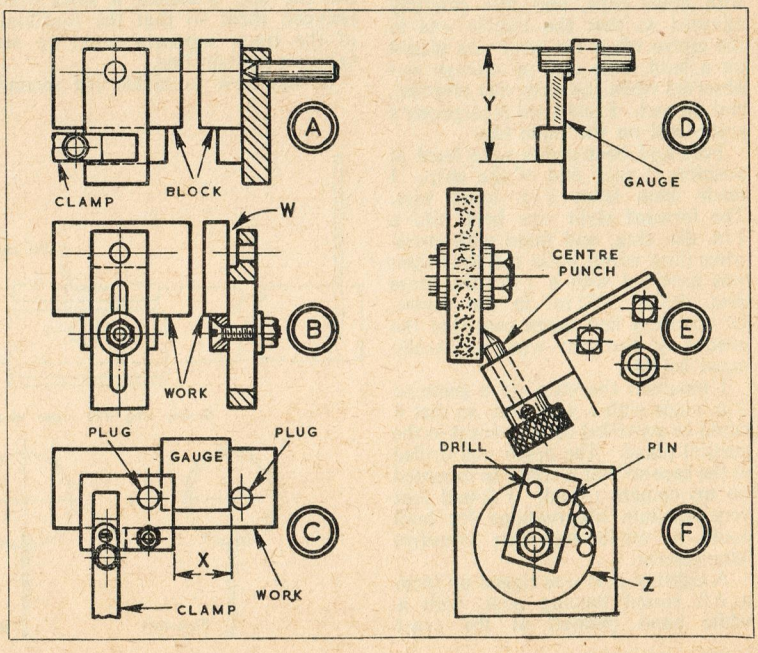
An alternative method of spacing holes is as at C. The position of one hole is centre punched. Then the hole is drilled and reamed and a plug is inserted. From this plug, a distance X to the edge of the plate can be obtained with calipers; or if there is a cut-away on the plate a thin gauge can be inserted to a second plug in the centre punch hole. The plate is then preferably of a size that admits of holding to the work with a toolmaker's clamp. In this way, with a thick plate, drilling can be done direct.

A thin gauge, C, can be made from sheet metal. It is sheared oversize and finished to micrometer by draw-filing—rubbing edgewise on a Swiss file. If the gauge is made undersize in the process, the metal can be stretched for another attempt by careful tapping with a hammer on a block.

With any of these centre-locating devices, the basic setting from the edge of the work can be obtained as at D, using a block gauge (instead of calipers) between a plug in the centre punch hole and the stop strip. When the stop strip is of known thickness, distance Y can be taken over the strip and the plug by micrometer.

Centring in this way obviously demands centrality of the centre punch point, which is ensured as at E. Standard silver steel rod is used for its good fit in reamed holes. After being faced and pointed in the chuck, the punch is hardened and tempered. Then its point is finished against a grinding wheel on a mandrel in the chuck. It is in a hole in a bar on the slide and is turned by a knob.

The general principle of centring and drilling is applicable, F, to cutting a large hole, Z, by drilling a series of small ones, while maintaining control over their spacing by a pin in the jig plate. ▣



My GARDEN TRACK in Sussex

By H. E. WHITE

AFTER having had a house erected on two-and-a-half acres of wooded hillside in Sussex, I began to think of building a track for 3½ in. and 5 in. gauges. The problem divided itself into three distinct parts: finding and setting out a suitable site for as long a track as possible, erecting the posts and track supports, and making and laying the track itself.

Finding a suitable location for the longest possible straight run was difficult. The plot was thickly wooded and very rough, with a slope of 1 in 6. Eventually I found a site for nearly 200 ft of track along the geologist's "line of strike"—across the line of maximum slope.

For the surveying (that is what I called it) I used a simple level-sighting device. As Fig. 1 shows, it was simply a strip of wood, 2 in. wide, ½ in. thick, and about 3 ft long. A recess was cut in the middle to take a glass spirit-level element (bought at Woolworth's).

The element was mounted in place with brass clips, and was carefully adjusted so that the bubble was in the centre when the strip was placed on a level table and no change was observed when the strip was reversed, end for end. I had used a carpenter's spirit-level on the table top.

Fore and back-sights were fixed in position at each end of the strip. I made them from ⅛ in. brass wire. The forward sight was bent into a 1 in. dia. ring, and fitted with cross-wires (fuse wire), while the back-sight was provided with a 1 in. dia. brass disc, drilled 3/32 in. in the centre. Of course, I had taken care that the centres of the two were at exactly equal heights.

I mounted the strip on a piece of 2 in. angle with a ⅜ in. bolt, so that it could be swivelled up and down in the vertical plane. The angle was drilled at the base so that it could be mounted on my camera tripod. I found that very accurate observations for level could be made with this primitive arrangement.

A sighting pole was rigged up from a 6 ft round fencing post, with a white band painted at the exact height of the sights on the surveying level. The height must be measured when the camera stand is placed normally in position on the ground: in my case it happened to be 5 ft. I carried out the surveying on my own, although it would have been much easier if I had had an assistant to move the pole about at my directions.

My procedure was to select a site by eye. I stuck the pole in the ground (an allowance in the position of the white band had been made for the embedded part) and surveyed the level from the other end of the proposed site. Differences in level could readily be seen, and an accuracy of about 2 in. in 200 ft was easily observable.

At last I discovered a location which allowed for about 180 ft of track, with a possible future extension to 200 ft. The difference in level at the ends was only 6 in.

Further observations showed that the highest point in the stretch was only 1 ft above the end-to-end level. Regarding this as satisfactory, I erected two 5 ft posts at each end of the site and stretched a stout cord between them so that the locations of the track supports could be set out in a straight line.

It was time to tackle the second problem. I am a member of the Sussex Miniature Locomotive Society, and I like the way that its track is made at Haywards Heath. Posts have been built up from brickwork, and bridge members of wood—old railway sleepers—are laid on top to form the track bed. I discussed this method with my local builder. He was keen on making up pre-cast concrete units, but I decided that the expense was too much. I had discovered that British Railways would supply me with sleepers of a suitable grade (No 6) at 4s. 6d. each, delivered to the nearest railway station. They were of sound weatherproofed timber, 8 ft 6 in. long, about 10 in. wide and 5 in deep

After estimating that this important part of the structure would cost less than £5, I went into the question of the brickwork The minimum permissible height of the posts was 12 in (four courses of bricks). This would make the actual height of the track above ground level about 18 in. at the minimum. As there was a difference of level of 1 ft throughout the site, the greatest number of brick courses would be eight.

Having worked out with the builder how the footings should be laid, I made a more detailed survey of the

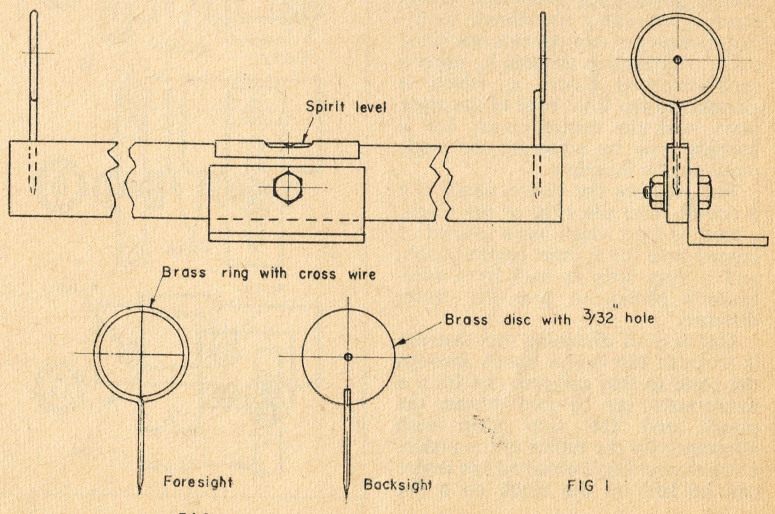
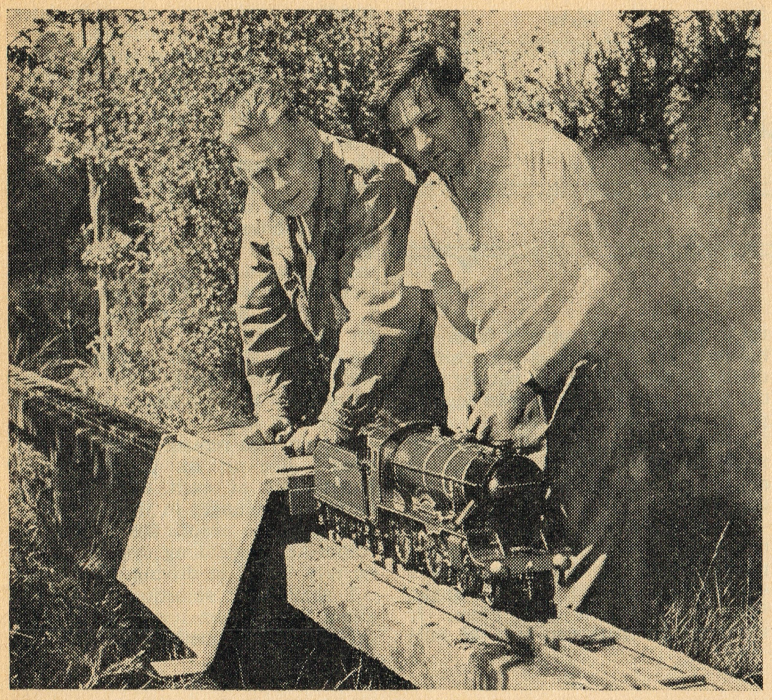


FIG 1



Leaning on the passenger truck, the author looks ahead—perhaps to a fresh idea for the enhancement of his dual-gauge railway on the wooded hillside

site, marking the exact position of each post with a stout stake, about 12 in. long, driven in to the correct level.

To do this I added another piece of apparatus, a 9 ft length of straight timber, 5 in. wide and 1 in. thick with an ordinary spirit-level carefully mounted in its centre, on one of the edges. I used the board to adjust levels between posts, and afterwards, to ensure that the brick courses were laid level in relation to the adjacent posts.

So as to avoid unnecessary digging, I decided not to lay all the footings at the same level, but to follow the contour of the ground as nearly as possible, at the same time keeping the tops of the posts perfectly level (see Fig. 2). The stakes marking the positions of the posts were driven in to such a depth that each was level with its neighbour or exactly 3 in. above or below it. Holes, about 18 in. square and 6 in. deep, were dug around them, and the footings were filled in with concrete mixture to the level of their tops. I had intended to do the bricklaying myself, but when the time came my courage failed me and I called in the local bricklayer and his mate. They did the job beautifully in a couple of days, and bedded each sleeper down in place with a mortar capping on every post, so that I had an even, level surface on which to lay the rails.

I do not like non-ferrous rails, although they have many obvious advantages. As they were too expensive—I needed about 600 ft.—I turned to ordinary black mild-steel bar which would cost about £10.

My only remaining problem was to fix the rails in position. I had oxy-acetylene equipment, and I seriously considered welding the rails to spacer bars. In the end I thought that it would be quicker and easier to use the good old-fashioned method with tie-rods and tubular spacers. I ordered 600 ft. of $\frac{3}{4}$ in. $\times$ $\frac{1}{4}$ in. black strip from a London stockist and it was delivered in 14 ft lengths. I cut each bar off to exact length, with squared ends, so that the bars would be identical and would fit closely together when they were assembled. With difficulty I heaved my milling machine round so that the steel bars could project through the workshop door when they were mounted by the ends on the milling machine table.

I arranged an outboard support to carry their weight. With a fixture made up and fitted to the miller table so that the bars rested squarely across it, I trimmed off the ends with a $\frac{1}{8}$ in. slitting cutter mounted on the mandrel, cutting six at a time, clamped together. In a comparatively short time I had 40 bars, all of exactly the same length, and with well-finished square ends, at the cost of very little labour.

The longest job was drilling the holes for the tie-rods. Owing to the difficulty of handling sets of 14 ft bars clamped together on the table of the drilling machine, I tackled each bar separately. Using a simple spacing fixture mounted on the drilling table, I drilled the fourteen $\frac{3}{16}$ in. holes for the tie-rods. For the fish-plate holes at each end, I used a separate jig. The drilling took a couple of days.

While I am sure that $\frac{1}{4}$ in. dia. tie-rods would have made a better job, I did not fancy the task of cutting $\frac{1}{4}$ in. BSF threads on each end of some 180 tie-rods with an ordinary circular die. I had brought with me from Southgate a 60 ft length of portable track which I used in my garden there. It was assembled with $\frac{3}{16}$ in. tie-rods at 12 in. intervals.

Although it had been out of doors for over five years and was very rusty, it was still rigid and in perfectly good order, and so I weakened and plumbed for $\frac{3}{16}$ in. tie-rods. They were parted off to length, with a stop to provide accuracy and rapidity, and were screwed 2 BA at each end, with a $\frac{13}{16}$ in. circular die held in the tailstock die-holder. It was tedious work; the die needed careful handling to prevent torn threads.

The spacers on my original track

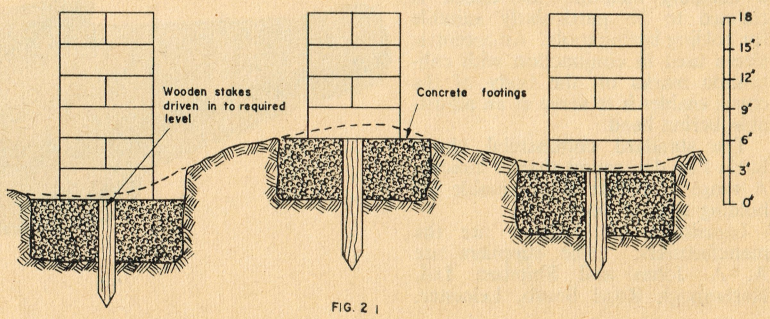


FIG. 2

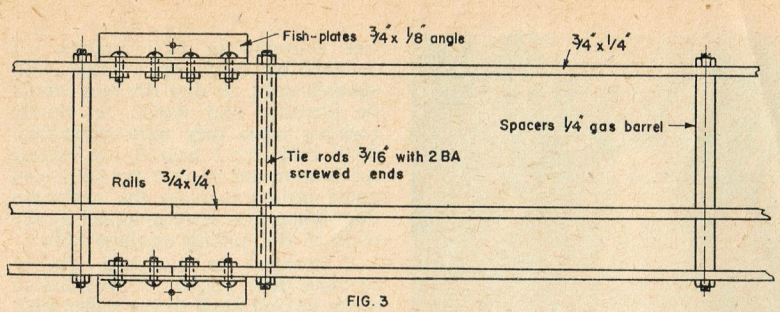


FIG. 3

had been cut from $\frac{3}{8}$ in. dia. heavy gauge steel tubing. When I worked out its cost for the new track, I was a little worried until it occurred to me that I might use $\frac{1}{8}$ in. gas barrel, which was much cheaper. I was fortunate to discover 100 ft or so of old $\frac{1}{4}$ in. barrel, which I bought for next to nothing. This, I found to my delight, would just pass through the hollow mandrel of the lathe. I cut it up roughly into 4 ft lengths and parted them off to make 180 $3\frac{1}{2}$ in. and 180 $1\frac{1}{4}$ in. lengths. Using the same trick as for the tie-rods, I fixed up a stop-piece to project from the tailstock barrel, adjusted the position of the saddle so that the parting tool cut off at exactly the correct length, parted off, and then fed the tube forward until it touched the stop again, repeating the whole process until the desired number of pieces were produced.

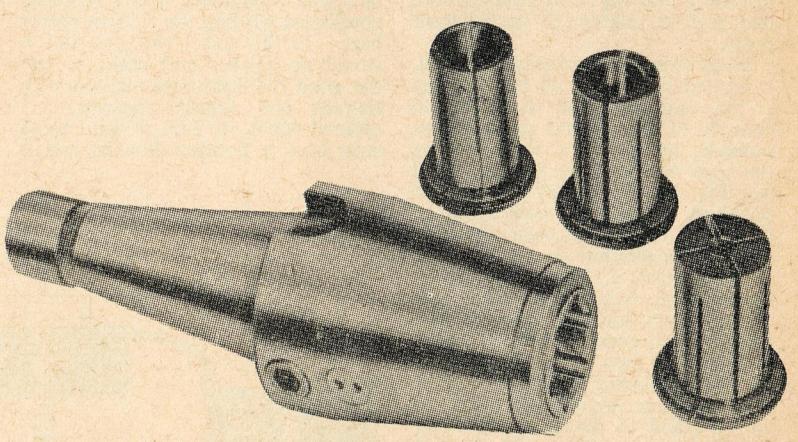
I assembled the 14 ft lengths of track and placed them in position on the track-bed. The fish-plates were 4 in. lengths of $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in. angle, jig-drilled with four $\frac{3}{16}$ in. holes. It was a simple matter to butt the rails together, and screw the fish-plates in place with $\frac{3}{16}$ in. round-head screws and nuts. The fish-plates were fastened to the track-bed (the sleepers) with $1\frac{1}{2}$ in. galvanised tile nails, through holes drilled in the base of the angles.

I suppose that the rail-assembly should be given some sort of protective coating. But I remember that when I painted my other track with a rust-proofing bituminous paint the brake gear on the passenger trucks, and the brakes on the tender of a friend's locomotive, were badly fouled by it. I, therefore, hesitate to put anything on the rails until I come across something that will protect them without transferring itself to the wheels and running gear. Perhaps a reader can help ?

Several jobs remain to be done. I should like to fix up pneumatic buffer-stops at each end, using a barrel and plunger in the style of a cycle-pump to absorb the shocks. A colour-light signalling system would be very useful in driving backwards.

I shall have something to think about in the next few months—and perhaps even something to do. ▣

HYDRAULIC COLLET CHUCK



It is possible to get a flat chuck adapter actuated by hydraulic pressure generated within the unit itself. The same principle has now been extended to the design of a hydraulic collet chuck.

In this tool, pressure generated in the body of the tool by turning a key is applied over the whole inner cylindrical surface of the bore of the collet; as a result, a cylindrical tool shaft engaged in the collet is retained with a very firm grip, but can be released instantlv by releasing the pressure. The holding force is adequate to transmit torque for tapping $1\frac{1}{2}$ in. Whitworth in steel when the tap is gripped in a 1 in. chuck.

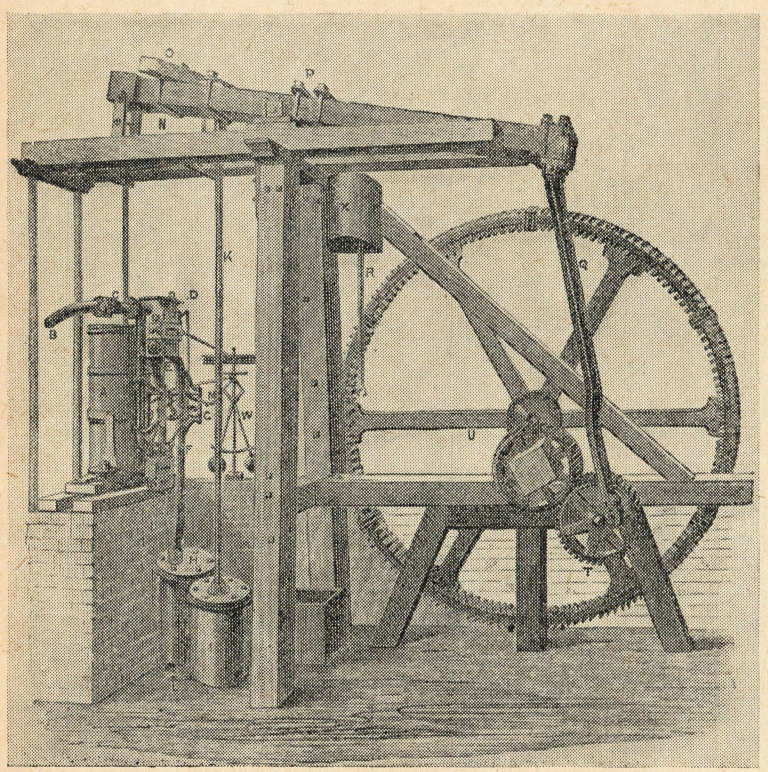
Because the hydraulic oil acts as a damping medium, the chuck is claimed to be particularly suitable for holding boring tools. An eccentric sleeve used in conjunction with calibration marks on the body of the chuck enables it to serve as an adjustable boring head.

The standard commercial chuck holds 1 in. dia. round shanks directly. A range of collets is obtainable for holding smaller tools.

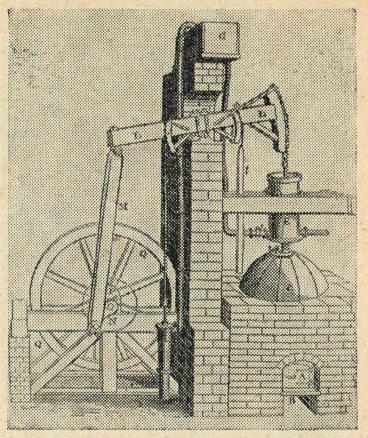
Lamalocks of Leicester are the manufacturers. The suppliers are A. A. Jones and Shipman Ltd, Narborough Road South, Leicester.

WATT was proud of his PARALLEL MOTION

" He seems to have regarded it as his greatest contribution to steam engine practice," says IAN BRADLEY in his third article on the Scottish pioneer



Watt's first rotary engine with Sun-and-Planet gear



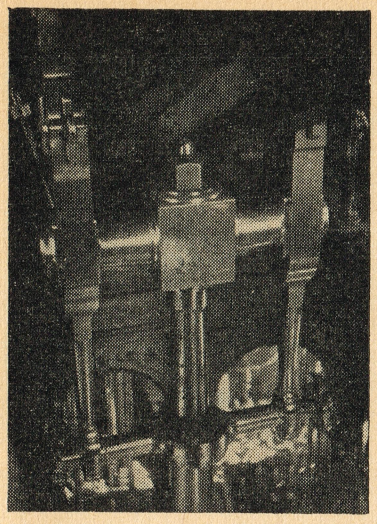
Rotative atmospheric engine (Farey)

THE success of the pumping engines turned the attention of Matthew Boulton and James Watt to the possibility of using the steam engine for driving machinery. At the outset Watt's position was that of a somewhat unwilling designer driven along by his more commercially-minded board of directors; in this instance, by Matthew Boulton, who had quickly perceived that in the new Age of Machinery three rotative engines could be sold for every pumping engine that was made in the Soho Works.

It is said that Watt would have been content to go on producing pumping engines only, feeling perhaps that this work, with its attendant duties of servicing engine installations, was as much as he could manage in his never-robust state of health. But his own inventive inclinations, together with Boulton's practical encouragement, soon broke down any lingering resistance that he may have felt. As a result, development work on the rotative engine was soon under way in the Soho Works.

Harnessing the beam

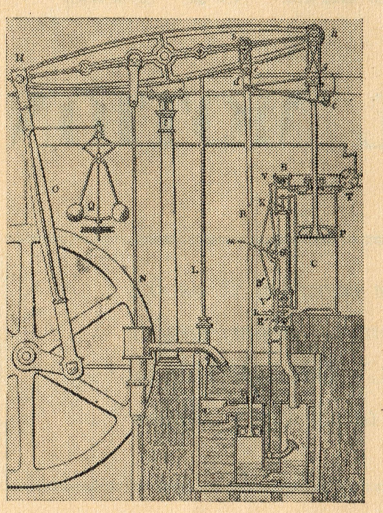
Inspired by the treadle gear of a lathe, Watt considered that the beam might be harnessed by a connecting rod to a short crankshaft with a flywheel mounted upon it. For some reason he did not trouble to take out a patent for this idea, perhaps thinking that there was nothing patentable in it. To his great chagrin he found that his idea of the crank had been communicated to James Richard of Birmingham by Mathew Washborough, a clever mechanic whom he sometimes



Above: Parallel motion at Littlemore Pumping Station, Oxford. Parts may be studied in this picture of the top of the connecting rod on the main force pump. Right: Double-acting engine in Dionysus Lardner's 100*-year-old book*

employed. Richard was granted a patent.

This was a severe blow, hard to overcome. Watt's solution, the use of planetary gear, could scarcely be considered an adequate substitute for the simplicity of the crank. Attempts had already been made to develop the Newcomen Atmospheric Engine so that it could be used for driving machinery; an example of this adaptation is seen in the illustration from John Farey's *Treatise on the Steam Engine* published in 1827.

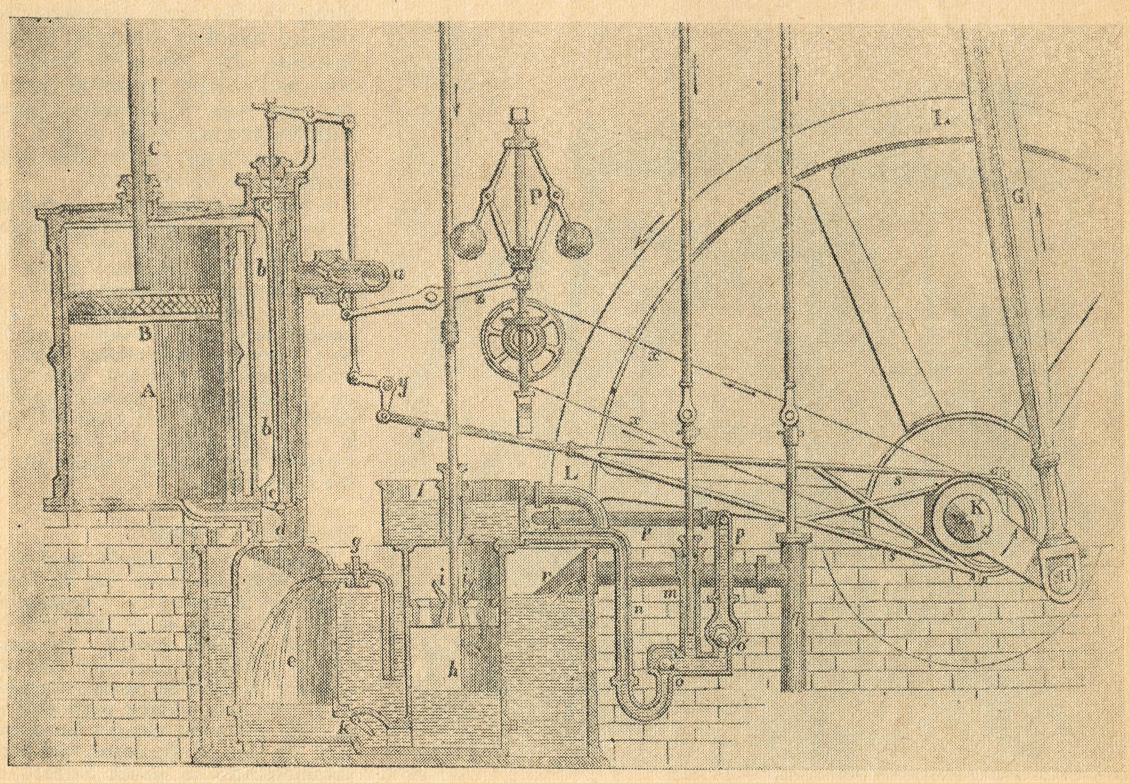


These attempts do not seem to have made much headway, largely, no doubt, because the engines were single-acting and worked at atmospheric pressure only. The mean effective pressure on the piston would thus have been very low.

Double acting

The designing of a rotative engine, so-called to distinguish it from the reciprocating one, led Watt to make the machine double-acting as he quickly saw that this would be essential to an even turning movement.

Now, the piston of a double-acting engine exerts a thrust on the beam in both directions. For this reason the old method of connecting the piston to the beam by chains was rendered obsolete, Watt made use of another and better mechanism. His device, the now-famous Watt's parallel motion, had been employed on a number of single-acting pumping engines erected in Cornwall. Watt himself considered the parallel motion an important



Working parts of Watt's double-acting engine, showing how the valves are operated by an eccentric

invention. Indeed, he seems to have regarded it as his greatest contribution to steam engine practice; writing to Boulton in 1784, he says: "Though I am not over anxious after fame, yet I am more proud of the parallel motion than of any other mechanical invention I have ever made."

Beautiful though the device is, engineering history can scarcely endorse this statement; the separate condenser stands out clearly as Watt's greatest contribution.

Watt was led to devise the parallel motion after he had experimented with other and more complex devices. As will be seen from Fig. 5, the mechanism consists of a system of links similar to that found in the pantograph. The piston rod is attached to a cross-member A anchored to the ends of a pair of links B and C which lie parallel with the long axis of the beam and are retained in position by two pairs of parallel links D and E, G and F attached to the beam itself.

If a point X is taken midway on AD it can be shown, either by a simple cardboard model or by plotting the movement of the point on a drawing board, that X will move up and down in a straight line. It follows, therefore, that a piston rod attached to this point will move in a straight line similarly.

The motion in use

In practice, Watt attached the connecting rod of his condenser air pumps to the centre of the link AD while the engine piston was connected at P to the end of the link OP, the same length as AD. As OA is equal to AB, AB is half OB and AX is half OP, for OP equals AD and AX is itself half AD. The two triangles ABX and OBP are therefore similar triangles; hence the point P will move vertically in a straight line in the same way as point X has been shown to move.

A practical application of the principle is shown in the illustration of the linkage connecting the main force pump at Littlemore Pumping

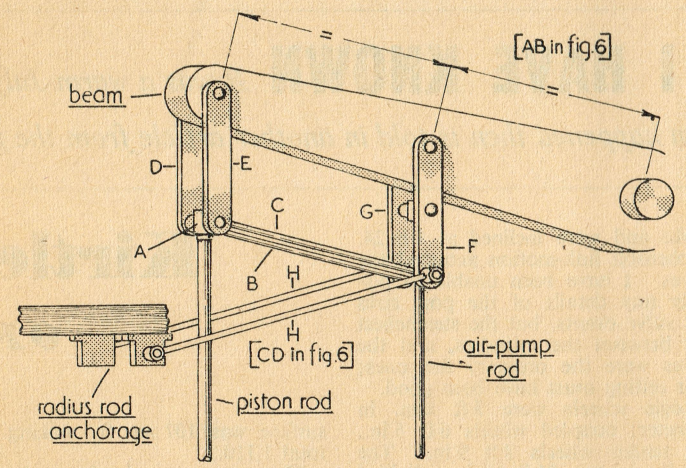


Fig. 5: Watt's parallel motion

The free ends of the swinging links G and F—the ends not joined directly to the beam—are connected by radius rods H to an anchorage usually bolted to the joists of the top floor of the engine room. The rods are equal in length to the distance from the centre of the beam to the pivot of the links G and F. (For the sake of clarity, those in the illustrations are shown longer.)

You can understand the action of the device from Fig. 6 where two members AB, CD of equal length turn in an arc on centres B and C respectively. They correspond to the part of the beam and to the radius rod H shown in Fig. 5, and their ends are joined by a link AD corresponding to the links F and G.

Station, Oxford. Here the cross-head of the pump rod is seen attached to the mid-point of links corresponding to AD in Fig. 6.

As will be seen from the general arrangement of the double-acting engine, the valve gear consisted of a set of steam admission and exhaust valves housed in chests at the top and bottom ends of the cylinder.

Though Watt was fully aware of the economy to be gained by using steam expansively, there is no evidence that he ever built any double-acting engines which worked in this way. All accounts infer that steam was admitted during the whole of the working stroke.

Originally the valves were operated by the air-pump rod as in the single-acting engine. Later an eccentric gear

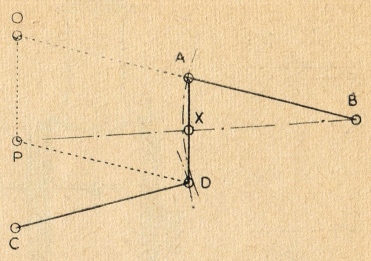


Fig. 6: Geometry of parallel motion

was used, but this refinement was added after Watt had retired from active direction in the Soho firm.

Later still, when the beam engine came to be manufactured by other firms, a camshaft was sometimes used to operate the valve gear. An example may be seen at the pumping station at Littlemore, Oxford.

Watt had perceived that a device would be needed to regulate the speed so that the engine could accommodate itself to varying loads. The method he invented was the ball governor. Its principle is so well-known that it scarcely needs any explanation. Suffice it to say that the balls, driven from the crankshaft of the engine by a belt, are caused to fly in a circular orbit. Because of centrifugal force, if the speed of the engine increases the balls will tend to fly outwards, and when the speed decreases they will again move towards the centre of their orbit. The balls are attached to a system of links that control the movement of a sleeve sliding on the governor spindle and attached to a rod connected to a butterfly valve in the main steam pipe. The movement of the balls will therefore open or shut the throttle valve as the speed of the engine rises or falls.

★*To be continued on May* 18

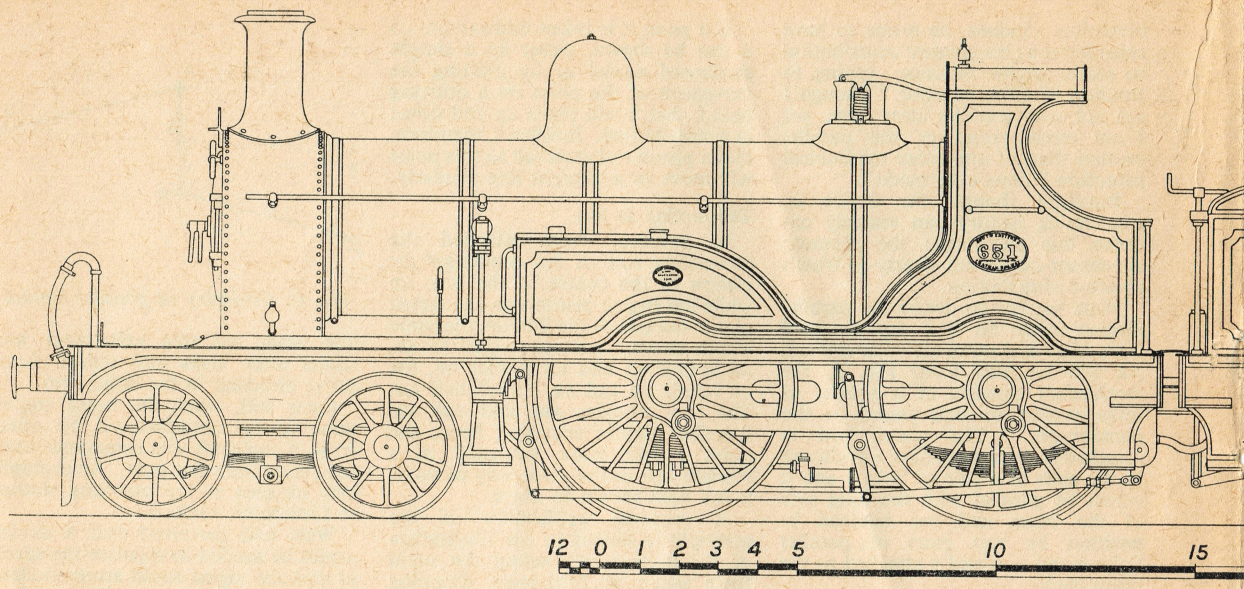
THE PACIFIC LOCOMOTIVE

To many enthusiasts the Pacific engine represents the peak of locomotive development, particularly in Britain.

Martin Evans, well known for his authoritative articles on model locomotive construction, has made an intensive study of this type of engine and his book *Pacific Steam* is a collection of his researches.

Famous engines are described and their characteristics discussed; the work of famous designers is considered in the light of ultimate achievement. Record breaking runs and performances of outstanding merit are quoted at length.

Pacific Steam, price 12s. 6d. (13s. 2d. by post), is published by Percival Marshall, 19-20 Noel Street, London WC1.



LOCOMOTIVES I HAVE KNOWN

It was a warm July evening

7.41 had come in late. What happened then is told in another article from the papers of

Kirtley's

OF THE

I FIRST came to know the Kirtley 4-4-0s in 1903 when my parents rented a week-end cottage at Whitstable, Kent, on the old London Chatham and Dover main line between Faversham and Ramsgate, where these engines worked most of the passenger trains.

They were fascinating machines; rather small in size, but distinctly lively and powerful. Their design was by William Kirtley, and Neilson and Co., of Glasgow, built six of the engines in 1877. Longhedge Works, Battersea, produced two in 1880, two in 1881 and a further two in 1885, while Dübs and Co., of Glasgow, delivered six in 1884. The Vulcan Foundry, of Leeds, built another six in 1891, and between 1892 and 1901 Longhedge made 20 more, two at a time, to bring the total number to 44. There were slight variations of detail and dimensions from batch to batch, and the class was officially divided into four—M, M1, M2 and M3—though the engines were all very much alike in appearance.

My drawings show No 651, of class M3, chosen for a reason that will be clear later. For the M3 class, cylinders were 18 in. dia. bore × 26 in. stroke and were inclined at 1 in 24. Stephenson link-motion actuated the valves. I have been unable to discover any details of the port sizes and valve events, but the steamchest was between the cylinders, and the valves were the ordinary flat ones; their setting must have been good.

Bogie wheels were 3 ft 6 in. in diameter; coupled wheels 6 ft 6 in., and tender wheels 3 ft 9 in. The wheelbase was 21 ft 0½ in., divided into 5 ft 9 in. plus 6 ft 11½ in. plus 8 ft 4 in., while the overhang was 1 ft 11½ in. at the front and 4 ft at the back. From the trailing coupled axle to the leading tender axle the distance was 8 ft 8¼ in. The tender wheelbase was 12 ft equally divided, and the length of engine and tender over buffers was 50 ft 4 in.

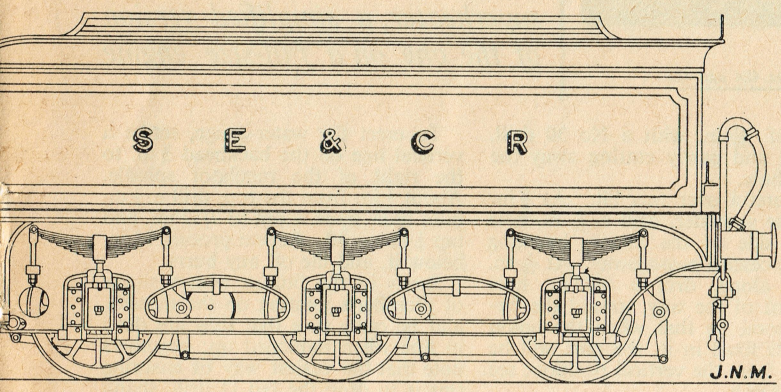
The boiler was made of $\frac{7}{16}$ in. plate, in two rings of 4 ft 2⅛ in. and 4 ft 3 in. dia. Its barrel was 10 ft 3 in. long and the distance between tube-plates was 10 ft 7 in. There were 207 tubes of 1¾ in. dia., with a heating surface of 1,003.2 sq. ft. Working pressure was 150 p.s.i., and the pitch of the centre-line 7 ft 2 in. from rail level. The length of the firebox shell was 5 ft 9 in.; the inner box was 5 ft 0½ in. long and 3 ft 4½ in. wide. Grate area was 17 sq. ft ; the heating surface was 107 sq. ft, making the total 1,110.2.

There was room in the tender for 4¾ tons of coal and 2,600 gallons of water. In working order, the engine weighed 42 tons 9 cwt, divided into 13 tons 12 cwt on the bogie, 15 tons 13 cwt on the driving axle and 13 tons 4 cwt on the trailing axle. With 34 tons 3 cwt for the tender, the total was 76 tons 12 cwt.

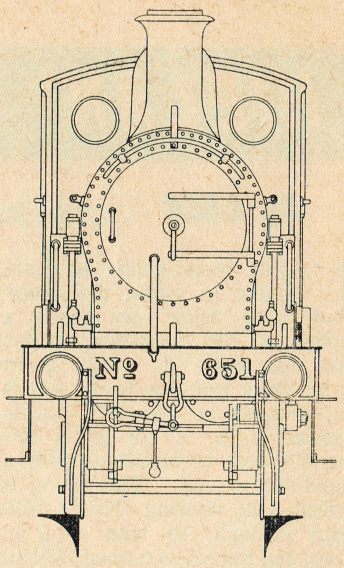
Class M3 had 26 engines built from 1891 to 1901. The eight in class M2 were turned out in 1884-5; they differed from the others in having 200 tubes, 17½ in. cylinders, 1,070 sq. ft total heating surface, 16.5 sq. ft of grate area, an engine weight of 43 tons, and a tender capacity of 2,470 gallons.

Unlike M2, M1 had 199 tubes, 1,069 sq. ft of heating surface, a working pressure of 140 p.s.i., and an engine weight of 42 tons.

Class M was similar to M1 except



20



35 years ago and the

J. N. MASKELYNE

4-4-0 Ms

E SECR

that it had a tender of 2,550 gallons capacity. Class M1 consisted of four engines constructed in 1880-1, and class M of six engines constructed in 1877.

It is also worth noting that all except four were designed and produced for the London Chatham and Dover Railway. The exceptions were the last four of class M3, built from 1899 to 1901; they did not belong to that line, but were SECR property from the beginning. All 26 of class M3 survived to become Southern Railway property in 1923; their withdrawal began in 1925 and was completed in 1928.

The work of the Kirtleys was always good, if not particularly outstanding; the old Chatham road, on which they ran almost exclusively, was relatively mountainous, and the trains were usually heavy, but the timetables seldom, if ever, called for overall average speeds as high as 50 m.p.h. until the Ms were well past their prime. They occasionally put up some runs that were rather above the ordinary. On 12 June 1896, No 16, later 475, of class M3 made a record run with the down Continental Night Mails train. The details published in certain technical periodicals at that time show that the load was a light one of 70 tons, including mails and passengers. But the engine was driven with considerable vigour, especially in the early stages; and achieved an overall time of just under 82 minutes for the 78½ miles to the stop at Dover Pier, at an average speed of 57.5 m.p.h. over a markedly switchback road.

Another M3, No 651, gave me an unexpected and quite brilliant run on the evening of 31 July 1926. I had been to Chatham and had decided to return by the 7.24 p.m. non-stop to Victoria. While I was waiting for my train, I watched 651 (by that time renumbered A-651 in the SR list) marshalling some coaches in the sidings alongside the station; and I recalled with nostalgia how she had been when I knew her 20 years before —a smart, game little engine. She appeared to be anything but smart and game, on that fine warm evening at Chatham !

At 7.24, there was no sign of my train. It arrived about eight minutes later—eight corridor coaches and a Pullman car, fully 245 tons, behind No 487, one of Harry Wainwright's D-class 4-4-0s, then newly rebuilt to D1-class. I noticed that the signalman had either guessed, or had been warned, that there was trouble, for he stood at his cabin window gazing at the train as it arrived, and he continued to gaze after it had stopped. The driver got down from his cab, made a quick examination of the engine's front end from which an ominous cloud of pale blue smoke was issuing, and then signed to the signalman that the engine would be detached. She drew forward and was backed into the sidings, alongside 651. The two crews exchanged engines, and 651 came off the sidings and backed on to my train, which I boarded with mixed feelings.

After the tender had been topped-up with water and the "right-away" given, 651 started that heavy train without difficulty. Slowly we passed into the tunnel west of Chatham station. Gaining speed to pass Rochester we ran over the Medway bridge and round the great curve to the foot of the formidable five mile Sole Street bank of 1 in 100, at 35.5 m.p.h. So well was the engine driven that we reached the top of the bank, seven miles from Rochester, in 16 min. 35 sec. at 20 m.p.h., before attaining speeds of 74 at Fawkham, 72 at Famingham, 63 at St Mary Cray, 66 at Bickley, 55 at Shortlands, 50 at Beckenham Junction, 44 at Catford, 44 at Nunhead, 38 at Peckham Rye and 36 at Brixton. We stopped in Victoria in 50 min. 10 sec. from Chatham—booked time 56 min., gain on schedule 5 min. 50 sec., average speed 40.5 m.p.h.

No 651 stood there, dirty, but apparently none the worse for her exertions. With only a few months to go before she was sent to the scrapheap early in 1927, she had shown me that she was still the same game little engine that I had always known her to be. She was Vulcan Foundry No 1322 of 1891. ▣

HIELAN' LASSIE

Once the water gauge is finished for the 3½ in. gauge LNER Pacific, the modeller begins work on the superheater, a simplified version of the one on a full-size engine

By LBSC

Continued from April 6, pages 424 and 425

LASSIE'S water-gauge is quite simple to make, the upper fitting being very nearly a replica of the clack-box, except that the body is made from $\frac{5}{16}$ in. brass rod; the lower end is not reduced in diameter, but is screwed $\frac{5}{16}$ in. × 32 for a few threads, and is furnished with a gland-nut to suit. The fitting is drilled $\frac{3}{16}$ in. clearing (No 11 drill) right through, to take a $\frac{3}{16}$ in. glass, and the top is tapped 7/32 in. × 40, and provided with a screwed cap like the one on the clack-box.

The lower fitting is a little more elaborate, as it contains the blow-down valve. Chuck a piece of $\frac{3}{8}$ in. round rod in the three-jaw, with a little over 1 in. projecting. Turn down $\frac{7}{8}$ in. length to $\frac{5}{16}$ in. dia., using a round-nose tool so as to leave a radius at the end of the cut, and then turn a small radius at the outer end, as shown in the sectional illustration, for appearance' sake.

Face centre, and drill about $\frac{3}{4}$ in. depth with No 48 drill. Open out for about $\frac{1}{4}$ in. depth with No 30 drill, and bottom the hole to $\frac{3}{8}$ in. depth with $\frac{1}{8}$ in. D-bit. Tap the No 30 part 5/32 in. × 32 or 40. Part-off at $1\frac{3}{16}$ in. from the end. Reverse in chuck, and turn down $\frac{3}{16}$ in. of the other end to $\frac{1}{4}$ in. dia.; screw it $\frac{1}{4}$ in. × 40, then centre and drill down to a depth of $\frac{11}{16}$ in. with a No 30 drill, meeting and partly cutting away the No 48 hole.

Be careful over this bit. At $\frac{3}{8}$ in. from the shoulder, drill a $\frac{3}{16}$ in. hole in the side of the fitting, breaking into the central passageway. At $\frac{5}{16}$ in. farther along, drill a 5/32 in. hole one-third of the way around the circumference, so that when the union nipple is fixed in it, the part will be 60 deg. from the vertical position; see detail sketch.

As the union nipple is just the same as the 7/32 in. × 40 nipple in the whistle-valve, I need not detail it out again. The nipple in the $\frac{3}{16}$ in. hole first mentioned is made in the same way, from $\frac{5}{16}$ in. round brass rod.

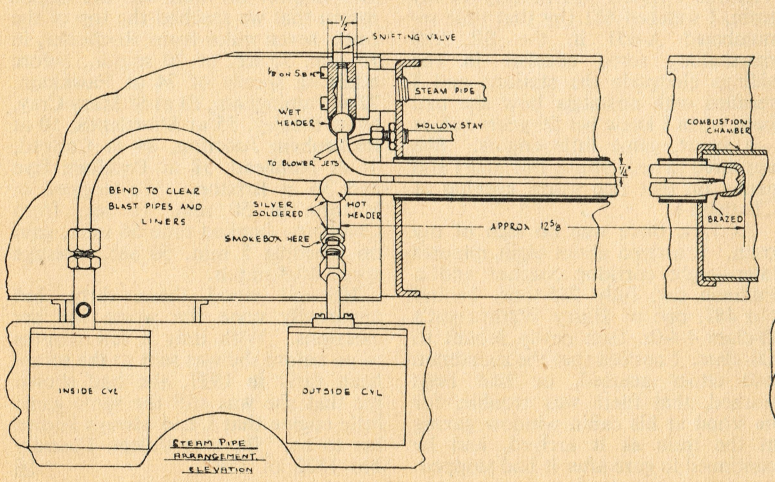
Chuck a bit in the three-jaw, face the end, centre, and drill to $\frac{3}{8}$ in. depth with No 30 drill. Open out to $\frac{1}{8}$ in. depth with No 11 drill; put a few 5/32 in. × 32 threads on the outside, and part off at $\frac{1}{4}$ in. full from the end. Reverse in the chuck, and turn a spigot $\frac{1}{16}$ in. long, to a tight fit in the $\frac{3}{16}$ in. hole in the fitting. Squeeze in both this and the blow-down nipple, silver solder them both at one heat, quench in pickle, wash off and clean up.

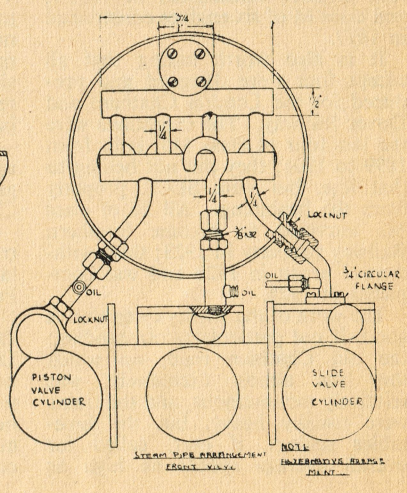
The valve pin and handwheel are made like the injector steam valve, except that the overall length is $\frac{5}{8}$ in. The gland-nut is made from $\frac{3}{8}$ in. hexagon brass rod, as described for union nuts.

To erect the water-gauge, scribe a vertical line on the backhead $\frac{3}{8}$ in. to the right of the regulator spindle. About $\frac{1}{4}$ in. from the top, drill a $\frac{1}{8}$ in. pilot hole, open it out to 7/32 in., and tap $\frac{1}{4}$ in. × 40. Repeat process $1\frac{3}{4}$ in. below it, and file off any burrs.

Screw in the fittings with a smear of plumber's jointing on the threads, and be quite sure that they are dead in line when tightened up; beginners note that the easiest way of ensuring this is to drop the No 11 drill, shank first, through the top fitting. It should enter the recess in the gland of the lower fitting quite easily, without any coaxing; and both the gland-nuts should turn quite easily by finger pressure only, with the drill in place.

The glass is a piece of $\frac{3}{16}$ in. glass tube approximately $1\frac{3}{8}$ in. long, which can be cut easily by nicking it with a three-cornered file, and snapping with your fingers. The packing-rings are rubber; get a bit of rubber tube which, when slipped over the glass, will just enter the gland-nuts. If it is too large, chuck a bit of $\frac{3}{16}$ in. round rod in the three-jaw, slip the rubber on it, run the lathe as fast as possible, and hold a bit of fine glass-paper against the rubber, which will speedily reduce it to size. If you apply a wet discarded safety-razor blade to the revolving rubber at bare $\frac{1}{8}$ in. intervals, you will find that when you push the rubber off the rod, your packing rings are already made. Wet the glass,





insert the top fitting. Put on a ring, and then the two gland-nuts back to back, and then another ring. Let the glass drop into the bottom recess. The gland-nuts can be slid into position, taking the rings inside them, and can be screwed home.

The superheater, which is of the multiple-element firetube type, follows full-size practice. It is a simplified version of the one used on full-size locomotives.

There are three distinct sections—the wet header, which carries the vacuum relief or snifting valve and is attached to the flange of the main steam pipe; the four elements, which reach to the combustion chamber; and the hot header, from which diverge the pipes conveying the hotted-up steam to the cylinders.

We will begin with the elements. Four pieces of $\frac{1}{4}$ in. × 20 or 22 gauge copper tube approximately 13 in. long are needed for the upper members, and four 12$\frac{1}{4}$ in. long for the lower. One end of each longer piece is bent to a right-angle, as shown. I explained how to make these bends in dealing with the exhaust pipes, and the leading ends of the shorter tubes are left straight.

The rear ends may also be left straight until the block return bends are brazed on. To make the bends, four small blocks of copper are needed, measuring approximately $\frac{1}{2}$ in. × $\frac{5}{8}$ in., and about $\frac{5}{8}$ in. thick. On one of the long sides, make two centre-pops a little over $\frac{1}{4}$ in. apart, and drill them to a depth of $\frac{3}{8}$ in., the two holes converging so that they break into each other just inside the edge; see sectional illustration.

Use letter D drill which is a tight fit for the $\frac{1}{4}$ in. pipes; otherwise use $\frac{1}{4}$ in. Insert one bent pipe and one straight pipe into the holes, letting them go in about $\frac{1}{8}$ in.; then braze the joints. Do not use silver solder; use either brass wire, brazing strip, or better still, Sifbronze.

Quench in acid pickle, wash, and clean up; file the blocks to the shape shown, and then bend the tubes so that they are parallel from just outside the return bend, to the other ends.

If any builder prefers making spear-heads to block bends, he can do so; they will be just as satisfactory. The main reason why I now specify block bends is that I have had so many complaints about beginners who get the spear-heads bunged up in doing the brazing. It would puzzle them to bung up the holes in the block, even if they wished, as long as the pipes were a good fit in the holes.

A casting may be provided for the flange; in which event it will need only facing and drilling. Alternatively chuck a piece of 1 in. round brass rod in the three-jaw; face the end, centre, and drill down $\frac{3}{8}$ in. depth with 9/32 in. drill. Part off at $\frac{1}{2}$ in. from the end; if a casting is used, reverse in the chuck and face the other side, to give the screws a smooth bed for their heads.

File a half-round groove a full $\frac{1}{8}$ in. deep in the edge, with a $\frac{1}{2}$ in. round file; or put the header flange under the slide-rest tool-holder and run it up to the side of a $\frac{1}{2}$ in. end-mill in the three-jaw. At the bottom of the semi-circular groove, drill a 9/32 in. hole, breaking into the blind centre hole.

The next requirement is a piece of $\frac{1}{2}$ in. × 20 gauge copper tube, 3$\frac{1}{4}$ in. long; in the middle, drill a 9/32 in. hole, and then, diametrically opposite (now *isn't* that stylish?) drill four holes at $\frac{7}{8}$ in. centres, as indicated in the end view, so that they come opposite the flues. Use letter D or $\frac{1}{4}$ in. drill, as for block bends. Plug each end of the tube either with discs of 3/32 in. sheet copper, or a couple of slices parted off a piece of brass rod turned to a tight fit in the tube.

Fit the four bent-up ends of the elements into the four holes; tie the flange to the top of the header tube with some thin iron binding-wire, or hold it in place with a brazing clamp, and silver solder the whole—flange, tubes, and ends of header tube—at one fell swoop. Silver soldering is quite all right for the joints in the superheater at the smokebox end, as it is well away from the fire; and the joints will be of ample strength.

★ *To be continued*

Measuring tube eccentricity

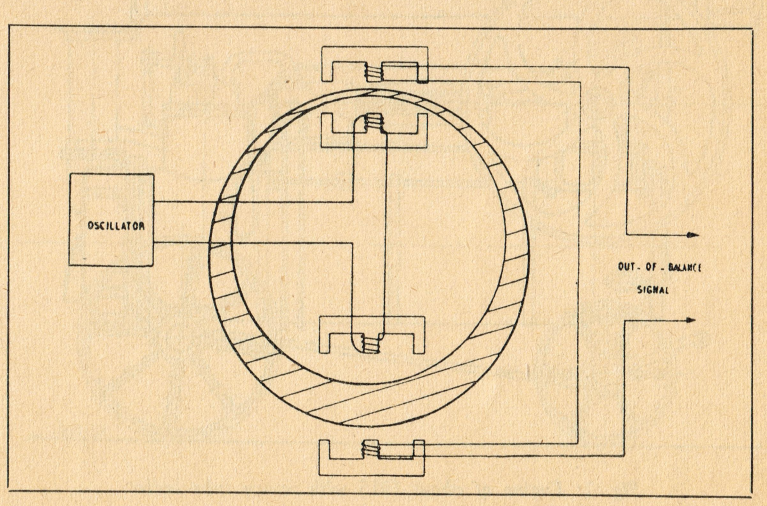
IN the manufacture of metal tubes there may be a departure from concentricity of the inner and outer bores, resulting in a variation of wall thickness round the tube. For many applications this is not a serious matter, but for some purposes, particularly when the tube has to withstand internal pressure, the strength of the tube is only that corresponding to its thinnest wall, and means of checking eccentricity may be important.

Any mechanical micrometric device for checking wall thickness becomes useless at more than a short distance from the end of the tubes, because of difficulty in obtaining sufficiently rigid support for the measuring probes.

A new method of gauging uses the metal wall of the tube as a screen between two coils forming a current transformer. The principle is illustrated by the diagram, which shows also how two such transformers are used at opposite ends of a diameter of the tube. If the wall thickness at each end of the diameter is the same, the circuit remains balanced; any difference results in an output signal, so that the system may be calibrated as a direct-reading eccentricity meter.

The principle is applicable to long tubes, provided that access is available at one end to introduce the internal coil unit at the end of a flexible probe and to take out the current leads.

This digest is based on "A Technique for Measuring Eccentricity in Metal Tubes," by B. E. Noltingk of Tube Investments Research Laboratories, in *Instrument Practice*, July 1960.



FAVOURED IN FRANCE

GEOFFREY K. KING, member of the Newcomen Society, writes a second article on French portable engines

BESIDES the engines mentioned in my last article, the Société Francaise had manufactured others. Fig. 7 shows a throttle-governed engine mounted on a return tube boiler. A similar variation for the expansion-governed engine could also be obtained.

The return tube boiler was an interesting design. By taking out the row of bolts around the backplate, the entire furnace, combustion chamber, tubes and back tube plate could be removed for cleaning, inspection or repair. Steam was drawn from a large dome on the rear of the boiler where the two spring-balance safety valves and the pressure gauge were mounted. The regulator was on the right-hand side.

There was a water column on each side of the boiler, the one on the right carrying the water gauge and the one on the left two test cocks. The drawing of the left side shows the cross-head pump.

The engines seem to have been made in semi-portable form with any one of the three boilers, or as stationary horizontal engines with separate ones. In 1915 the firm was still producing quite large stationary French or Elephant boilers whose large steam and water drum, often with fire tubes, was placed above two smaller drums for water. The whole was set in brickwork, with the furnace between the lower drums.

Four rather large connecting passages, projecting downwards from the large upper drum, probably explains the nickname "Elephant." While the boiler was little used in Britain after the middle of the nineteenth century, it remained popular in France until fairly recent times.

By far the most advanced design of portable engine produced by the Société Francaise was a very original one embodying a superheater and balanced poppet valves; Fig. 8 shows the left side. The engine proper was still a separate unit, but the flat bed-plate was replaced by a bayonet frame into which the cylinder was spigoted, leaving the rear portion overhanging. Integral with the frame were the bored guide for the cross-head and the seatings for the lower halves of the crankshaft bearings, the frame being carried on two mild steel saddles riveted to the boiler barrel. The crankshaft had an over-hanging disc crank. Only one rather heavy flywheel with straight spokes was fitted on the right.

The boiler, of an ordinary locomotive type, had a rectangular firebox with a Garrett-type self-supporting crown and a rather long smokebox to accommodate the superheater.

Steam pressure was 12 kg/cm² instead of 8 kg./cm² as in the engines I described earlier.

A small cast dome on the rear of the boiler carried two spring balance safety valves, the pressure gauge and a whistle. It also served to support the chimney crutch. From a stop valve just in front of the crankshaft, steam for the engine was taken by a pipe into the right-hand side of the smokebox to the superheater, the outlet pipe emerging on the left-hand side and passing under the rear boiler saddle to the engine stop valve, just below the cylinder.

Fig. 9 shows the right-hand side of the engine and the exhaust system, the feed water heater on brackets at the side of the boiler, and the eccentric driven feed pump with its connections to the feed heater and check valve. The most novel feature was the valve gear.

Four double-seated poppet valves, arranged vertically, were opened and closed by rockers operated through cams on a horizontal shaft which was given a reciprocating motion by an eccentric on the crankshaft. The throw of the eccentric was varied according to the load by a centrifugal governor on the crankshaft, whose backplate can be seen behind the flywheel.

A long stroke to the cam rod gave a late cut-off for starting and running under maximum load, while shortening the travel made the cut-off progressively earlier. The sharp cut-off of the drop valves, together with the ability to use high ratios of expansion, allowed the greatest use to be made of the superheated steam. The valve gear could be applied to a reversing engine with ordinary Stephenson link motion, the expansion being regu-

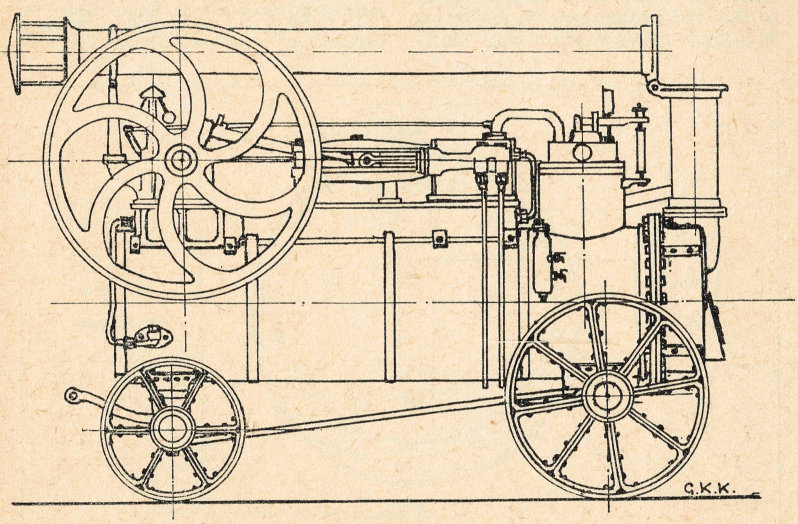


Fig. 7: Engine of about 1915 with return tube boiler

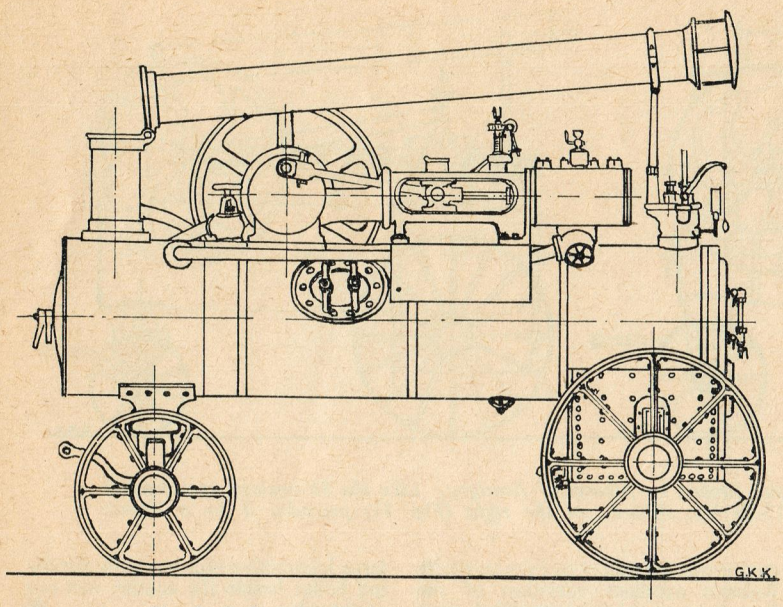


Fig. 8: *Left side of superheated portable by the SF*

lated by hand in the normal method of linking up, though, of course, any automatic governing then had to be done by a throttling governor. Traction engines with this arrangement were made by the Société.

Apparently the Société produced all these types of portable up to 1915 and probably later.

One of the oldest builders of portable engines in France is Albaret of Rantigny; I believe that Albaret will still build a portable on request. Fig. 10 shows in outline its most popular model, which had a boiler with a round firebox very similar to the one described earlier and illustrated in Fig. 4. The top works were mounted on a separate bedplate less obtrusive in appearance than those which I have illustrated before.

The most distinctive feature of the engines was the use of a circular slide valve, similar to the valve used by Webb on a few L & NWR locomotives, by Massey Bromley on a few GER locomotives, and by Fowler on a few ploughing engines. These British experiments were soon abandoned, but the Albaret firm seems to have been much more successful. It continued to use the valve for many years on its portables and on its traction engines and steam rollers as well. The valve was completely circular on both steam and exhaust edges, and also on the part which was engaged by the circular bridle used to drive it. The ports in the port face were curved to correspond, so that the valve could turn round in the bridle without in any way affecting the valve events, the idea being that this freedom of rotation given to the valve reduced any tendency for the valve to seize or to score the faces.

Governing was by a high-speed loaded governor driven by belt and bevel wheels. A crosshead-driven feed pump was provided on the left-hand side of the cylinder and a curved spoke flywheel was fitted on each end of the crankshaft. The road wheels had round spokes cast into the hubs.

The engines were made in five sizes: from 6-8 h.p. (cylinder 140 mm. × 280 mm. at 140 r.p.m., flywheels 1.200 m. dia.), to 14-16 h.p. (cylinder 190 mm. × 350 mm. at 115 r.p.m., flywheels 1.500 m.). Those of 8-10 h.p., 10-12 h.p. and 14-16 h.p., could be supplied with a return tube boiler very similar to the one for the engines by the Société Francaise.

In 1905 Albaret produced a new model, rated at 15-20 h.p. (Fig. 11), which in general appearance much more nearly followed English practice. It had a rectangular firebox. The cylinder and crankshaft were mounted on separate saddles without any connecting bedplate.

Small cylinders

One flywheel only was fitted, on the right-hand side. The circular slide valve was retained, together with the high-speed governor. The cylinder was 220 mm. × 300 mm., at 140 r.p.m. and the flywheel was 1.500 m. diameter. It is rather strange that this engine, with a bore and stroke of only about $8\frac{5}{8}$ in. × $11\frac{7}{8}$ in., seems to be the largest listed by Albaret as a standard product. I believe that Albaret made larger engines; but evidently its main business was with small ones.

The spring-balance safety valve was favoured in France. Although it survived to a certain extent on portable engines in Britain, in most later examples it was used only with a direct loaded lock-up valve. At the Royal Show at Lincoln in 1947

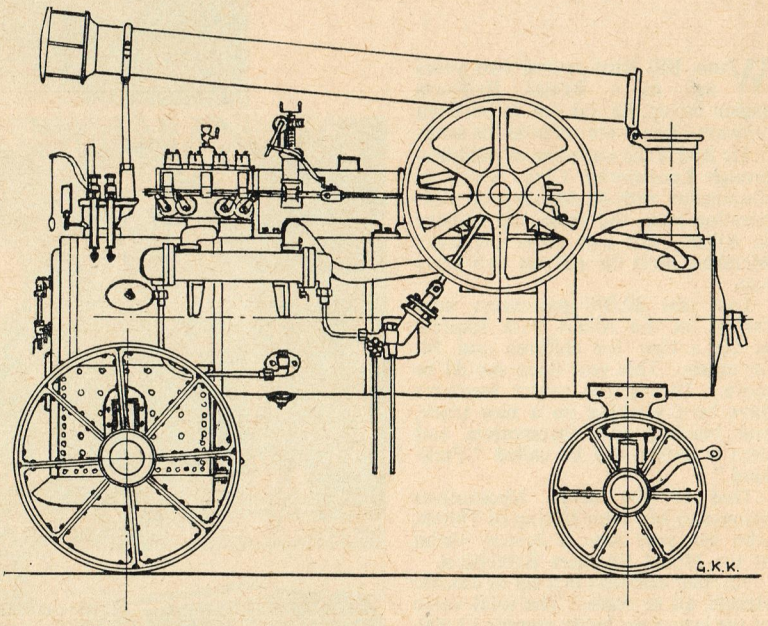
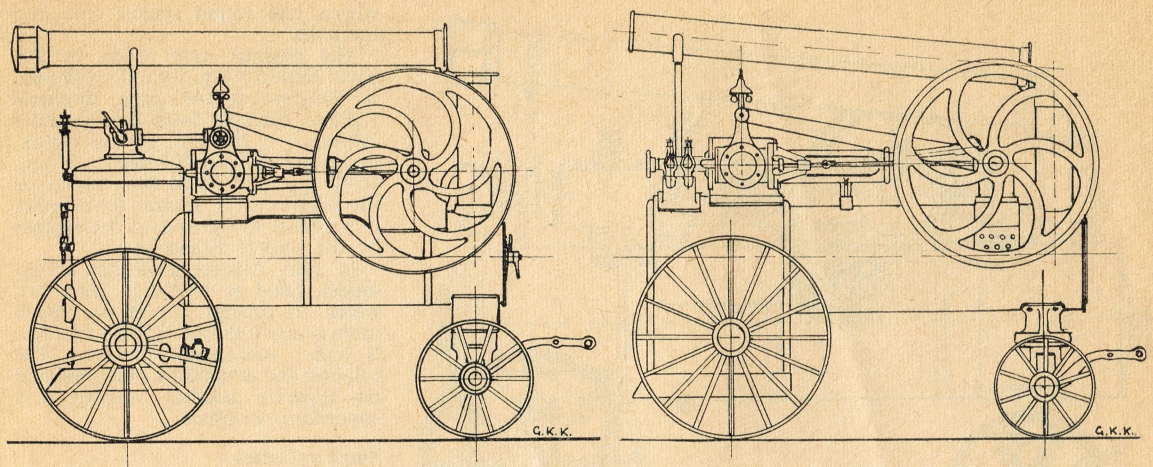


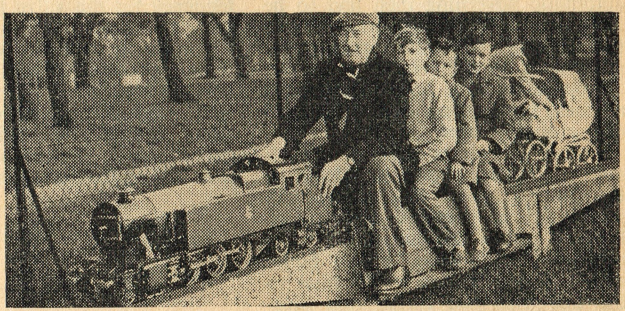
Fig. 9: *Right side shows the drop valve gear and feed-water heater*

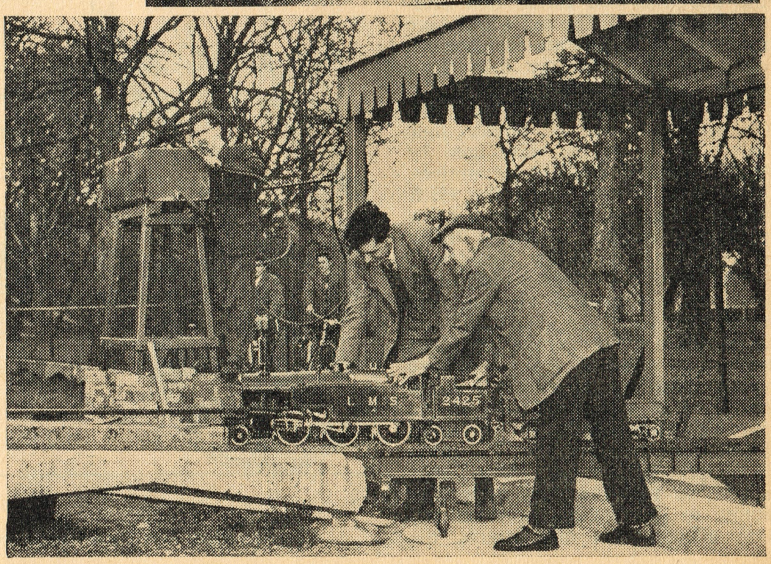


Above, Fig. 10: *Engine with circular firebox by Albaret of Rantigny. Like the SF engines, this machine was made in about* 1915. *The* 15-20 *h.p. Albaret on the right* (*Fig.* 11) *preceded it by a decade*

Robey exhibited a portable engine of very modern design with two spring balance valves. I was told that the engine was for export to France, where Robey's excellent variation of the Ramsbottom valve, exemplified on a large locomotive type portable sterilising boiler beside the engine, was not approved. ▣

Driver Bird changes scale





WHEN Bill Bird retired two years ago as a British Railways engine driver, he did not retire from railways—he simply reduced his scale.

Mr Bird is the secretary of Middlesbrough Locomotive Club, which in conjunction with Middlesbrough Corporation runs the miniature railway in Albert Park (see cover pictures). Members built the railway two years ago.

Last year 30,000 passengers were carried on the Albert Park Express at 2d. a time for children and 3d. for adults. This year there should be more. During the winter members have been working on a new track, and building new locomotives and even a station—to be called "Parkland."

One of the seven locomotives belongs to Mr John Heslop of Thirsk, who last year won a bronze medal at the Model Engineer Exhibition.

Another addition is a set of electric signals, all to scale. The total value of the layout probably exceeds £3,000. —M. LARKIN.

FIREFLY

A GWR 2-6-2 TANK ENGINE OF THE 45XX CLASS

Described in three gauges by MARTIN EVANS

Continued from 20 April 1961, pages 488, 489 and 490

BRAKE gear for the 3½ in. gauge 2-6-2T follows the 5 in. model very closely. The brake blocks can be cut from ½ in. × ¼ in. b.m.s. or from 1¼ in. × ¼ in., according to the method adopted for machining them.

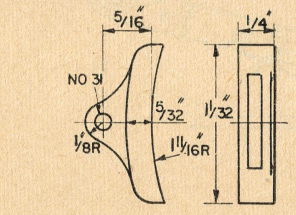
Two methods were discussed in my last article on the bigger engine. In this size there is a third possibility—cutting a disc of 3⅜ in. dia. out of a piece of mild steel sheet ¼ in. thick and about 4 in. square. It could be done by bolting the piece to the lathe faceplate, with spacing washers between to provide working clearance for the parting and boring tools necessary.

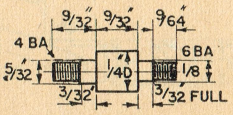
The six brake blocks are then sawn off and filed to shape, the No 31 holes drilled, and the slots in the backs for the hangers sawn or milled. If you want to end-mill the slot, it is a good plan to saw most of the metal out first, and then clamp each block in turn in a machine vice bolted to the vertical slide, and use the end-mill in the chuck or collet.

Cut the two full-length brake beams from ½ in. × ⅛ in. b.m.s. The short brackets for the trailing hangers are made from 5/16 in. × 3/16 in. b.m.s. or nearest larger, using the four-jaw chuck to turn the hanger end. I do not need to say anything about the hanger pins; they are straightforward turning jobs in ¼ in. dia. silver steel.

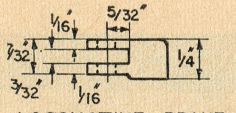
Before leaving the brake gear for the time being, perhaps I should mention that the brake cross-shaft is a 4⅜ in. length of ¼ in. dia. silver-steel working in gunmetal bushes which are pressed into the 5/16 in. dia. holes in the lower rear ends of the mainframes. The forked joints which connect the brake pull rods to the shaft lie on the insides of the mainframes and close to them so that the bushes should be flush on the inside of the frames.

As I mentioned in my introductory article, the pony trucks for the ¾ in. scale *Firefly* are deliberately made of extremely simple design, although the external appearance has a distinctly Swindon look. On the other hand, the design of the 5 in. gauge trucks will follow GWR practice rather more closely. I believe that this will be approved by most builders, as the refinements of individual axlebox springing and side control are not really essential in ¾ in. scale.

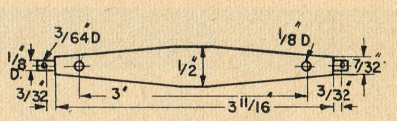




BRAKE HANGER PIN
6 OFF SILVER STEEL



LOCOMOTIVE BRAKE BLOCK 6 OFF BMS OR CI



LEADING & DRIVING BRAKE BEAM
2 OFF 1/8" BMS

It will be noticed that the leading and trailing pony trucks are not quite the same. The triangular framework of the leading truck is a separate item from the top plate which is bolted on the top of the axleboxes, whereas in the trailing pony truck this is one piece. In addition, the trailing pony truck is ⅛ in. shorter.

The axleboxes consist of ⅞ in. lengths (15/16 in. for the trailing truck) of ¾ in. × ½ in. drawn gunmetal bar. Castings can be used if preferred.

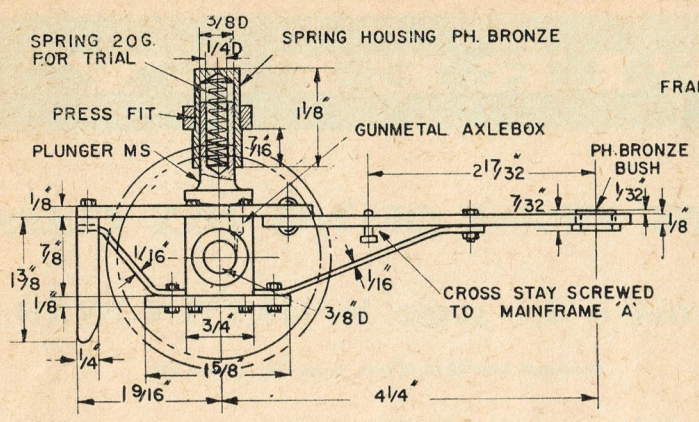
When bar is chosen, the boxes are first faced off to length and then mounted in the four-jaw, bored and reamed. A circular flange 1/32 in. deep is turned on one side.

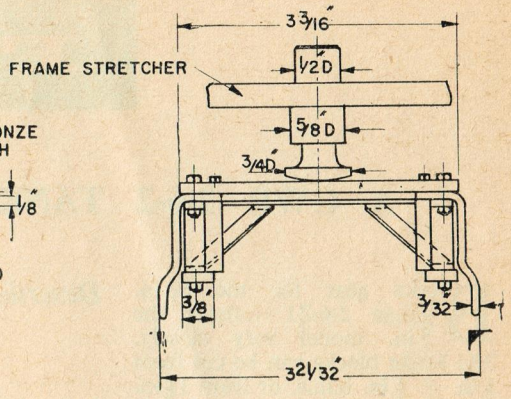
The top plate or plates are next cut out from ⅛ in. thick bright mild steel, followed by two lengths of ⅜ in. × ⅛ in. to represent the horn-stays. Guard irons are bent up in one piece from ¼ in. × 3/32 in. material, and the diagonal bracing is from ¼ in. × 1/16 in. bright mild steel.

Four 8 BA hexagon screws hold the top plate to the top of the axleboxes, and four are also put through the hornstays into the underside of the axleboxes.

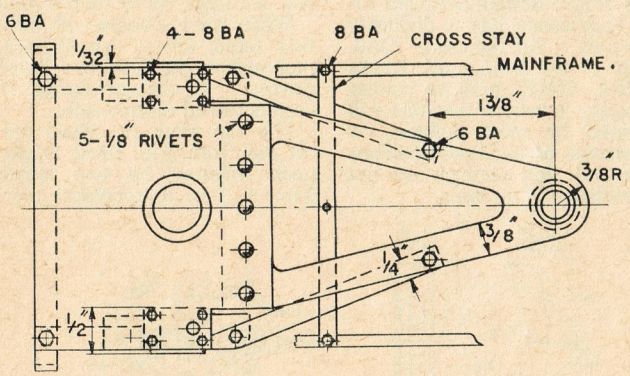
Drill the holes in the top plate and hornstays first, and then assemble temporarily with a couple of large toolmaker's clamps, putting a length of ⅜ in. dia. silver steel through the axleboxes to keep them in line. Bolt the parts together temporarily and bend up the diagonal bracing. This is held together with 6 BA hexagon-

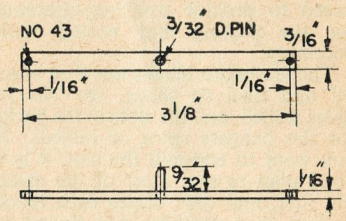
"I am keeping a check of the time taken to fabricate the various parts" . . . This instalment describes the brake gear and two pony trucks for the 3½ in. gauge model



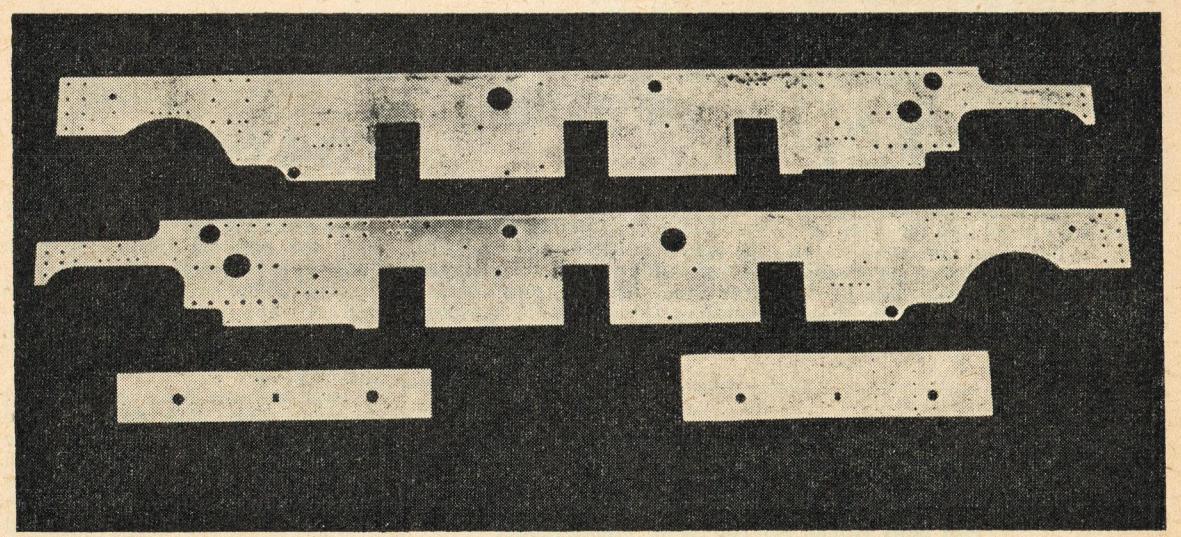


G. A. OF FRONT PONY TRUCK
SHOWING SPRINGING

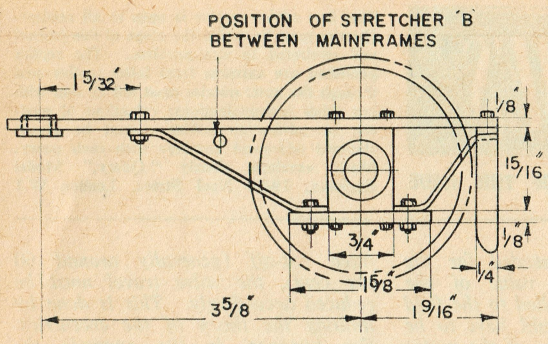




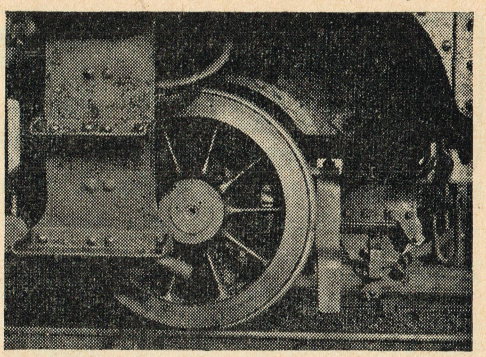
CROSS STAY 'A'
BMS



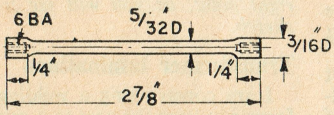
Mainframes and buffer beams for FIREFLY *in 5 in. gauge*



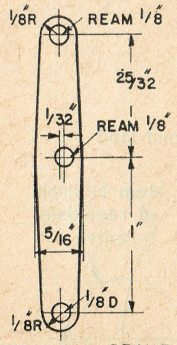
REAR PONY TRUCK DIMENSIONS NOT SHOWN AS FOR FRONT TRUCK. SPRINGING GEAR AS FOR FRONT TRUCK



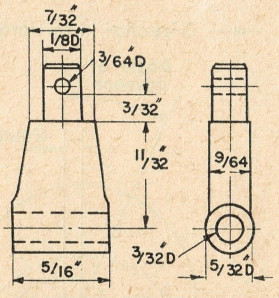
Wheel and guard iron on trailing pony truck



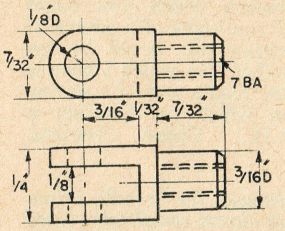
FRAME STRETCHER 'B'
SILVER STEEL



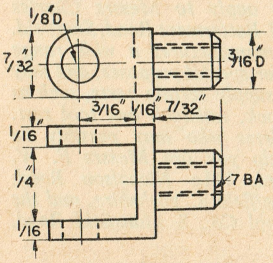
LOCOMOTIVE BRAKE HANGER 6 OFF 3/32" BMS



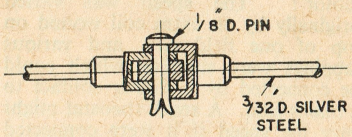
BRACKET FOR TRAILING BRAKE HANGER. 2 OFF BMS



FORKED JOINT FOR LEADING AND DRIVING BRAKE BEAMS
4 OFF BMS



FORKED JOINT FOR DRIVING BRAKE BEAM
2 OFF BMS



ASSEMBLY OF DRIVING BRAKE BEAM

head screws, each nutted on the underside.

The parts can now be dismantled, the bush for the pony truck pivot pin turned up and pressed home, and the two top plates of the leading truck riveted together.

Make the spring housing from a $1\frac{1}{8}$ in. length of phosphor-bronze $\frac{5}{8}$ in. dia., turned down as shown a press fit into the cross stretcher on the mainframe. In it works the plunger, which is machined from $\frac{3}{4}$ in. dia. mild or silver-steel made a nice working fit without shake.

The spring could be produced from 20 s.w.g. wire for trial. It may be too light in practice, but this can be settled when the locomotive takes the road for the first time.

Our remaining item is the cross-stay which prevents the pony truck from dropping when the engine is lifted off the track. The cross-stay on the leading truck is a $3\frac{1}{8}$ in. length of $\frac{3}{16}$ in. $\times$ $\frac{1}{16}$ in. mild steel strip, screwed on to the underside of the mainframes as shown, passing in between the top plate and the diagonal brace. On the trailing truck, the stay is a turned one, bolted between the frames by 6 BA countersunk screws.

Finally, you can fit the wheels and axles and assemble the pony trucks in position, using vibration-proof nuts on the pivot pins.

One of my pictures shows the beginnings of my 5 in. gauge *Firefly*. Since the picture was taken, the frames have been finished, the buffer beams have been made ready for attaching fixing angles, and some other work has been done. The sawing out of two frame plates in $\frac{3}{16}$ in. thick steel proved no ordeal. I am keeping a check of the time taken to fashion the various parts, in the belief that it will interest readers.

In my next instalment on the $\frac{3}{4}$ in. scale model, I shall be dealing with the cylinders, which are of the slide-valve type.

★ *To be continued on May 18*

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

This free advice service is open to all readers. Queries must be within the scope of this journal and restircted to one problem. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W.1

Treadle lathe

I have been trying to buy a treadle-operated wood-turning lathe, but have been unsuccessful as most manufacturers seem to make only power-driven ones these days. I, therefore, intend to try to make one of my own and would welcome any information which you could give me. If you know of a source of supply, perhaps you would let me know. Another idea which I have is to utilise the treadle unit of a sewing machine on which to construct a lathe.—E.A.H., Upper Tooting, London.

▲ *The demand for treadle driven machines has almost completely ceased in recent years. It is, however, possible that some lathe manufacturers may have parts for treadle drive in stock, or would be willing to make them up. You might apply to Messrs Charles Portass Ltd, Buttermere Road, Sheffield. This firm manufactures a wide range of lathes for special purposes, and may be able to supply certain parts, such as the headstock, tailstock and tool rest.*

Other firms who may possibly be able to help you are Messrs F. W. Portass Ltd, 141a Nicholson Road, Heeley, Sheffield 8, Yorkshire, and the Coronet Tool Co., 8 Mansfield Road, Derby.

Speed of electric motor

Could you recommend a suitable way of reducing the speed of a shunt wound 80 w., 250 v. cake mixer motor? The speed was varied originally by an extra coil wound on top of one field coil, and various tappings were supplied which could be connected by a sliding contact to a mains lead. A small rheostat might vary the speed if it were connected into the circuit to vary the field current, but I am not sure of the resistance to use.

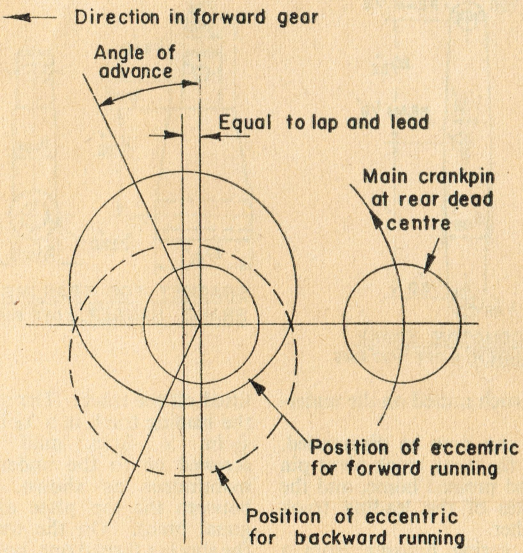
The armature has 24 segments. My reason for using a rheostat is that this coil has burnt out, but the field coils are still intact.—J.N.K.M., Melbourne Australia.

▲ *The usual method for a shunt-wound motor is to reduce the strength of the field, but this increases the speed, so that the addition of series resistance would be needed for the desired effect. The value of the resistance, whether applied to the field coils or in series, would have to be related to the resistance of the motor itself.*

Total valve travel

Can you please tell me if there are any formulae dealing with the setting of slip eccentric valve gear?

For example, how is the amount that the stop collar is cut back calculated, and what is the position of the pin on the eccentric? How is total valve travel determined?


Direction in forward gear
Angle of advance
Equal to lap and lead
Main crankpin at rear dead centre
Position of eccentric for forward running
Position of eccentric for backward running

If there are no formulae, can you explain a suitable geometric method of setting out, please?—E.T., Steyning Sussex.

▲ *The total valve travel is generally made twice the sum of the lap and the port opening; for a steam port of $\frac{1}{8}$ in. width and a steam lap of $\frac{1}{8}$ in., total valve travel would be $\frac{1}{2}$ in.*

As the slip eccentric is set to give a fixed cut-off (generally around 60 per cent), the valve travel must be reduced accordingly. This is done by limiting the throw of the eccentrics. For instance, in the example the throw of the eccentrics could be made 7/32 in. instead of $\frac{1}{4}$ in. The stop collar is then arranged so that the drive of the eccentric is taken up at the right point, as you will see from the sketch.

Transformer laminations

I am constructing a welding transformer to keep the cost to a minimum. I want to cut the transformer laminations myself. It has been suggested to me that this would give laminations of uneven flatness, with consequent vibrations.

Would you please confirm or deny this and also suggest firms who could supply me with suitable transformer lamination material?—A.P.T.J., Chalfont St Giles, Buckinghamshire.

▲ *There is no objection to your cutting your own stampings from*

suitable iron. The fact that the stampings will not all be of the same thickness has nothing to do with the noise a transformer may make after assembly. The thickness of stampings ties up with the frequency of the supply, and where a very high frequency is used the iron needs to be very thin. For frequencies in the region of 50-60 cycles, the thicknesses you give will be suitable. The only difference, if any, with a thick stamping would be shown as heat in the iron, but this you can disregard.

Stampings should be preferably stamped out in a die. Cutting to shape can be done, but the stampings after cutting should be quite flat. Flatten each stamping between two surface plates or similar flat pieces of iron, either in a vice or by using a hammer. Sheet metal can be dressed down level by hitting it with a hammer in the right spots.

If the stampings are flat and clamped up tightly, and all mating joints are in intimate contact, there will be no noise from the stack except, perhaps, a very slight hum. This is the end to attain in the construction of a transformer. Sankey and Sons Ltd, of Bilston, Staffordshire are suppliers of transformer stampings. They are unlikely to supply small amounts, but if they are prepared to do so there may be a charge of about 35s., regardless of the amount of the order, to cover the cost of handling and so forth.

Plans for gas engine

Could you please tell me where I could obtain plans for making a small working model gas engine ?—G.V.L., Northenden, Manchester.

▲ *Detailed plans of the Centaur 50 c.c. horizontal gas engine M.21 are obtainable from PM Sales Department at 7s. 6d. a set of three sheets, post paid.*

Welsh Highland

Please could you tell me where I could obtain some information on the Welsh Highland Railway ?

I am particularly interested in its locomotives and I would very much like to get some drawings of one of them, as I want to make a scale cardboard model.—C.P., Cardiff.

▲ *The Welsh Highland Railway was formed in* 1922; *it originated in the North Wales Narrow Gauge Railway constructed in* 1877. *The line, of 1 ft 11½ in. gauge, operated from Dinas to South Snowdon and was originally the easiest means of visiting Snowdon. On being taken over by the Welsh Highland Railway it was extended to Portmadoc and eventually linked up with the Festiniog Railway by use of the Croesor Tramway.*

The WHR owned three locomotives: MOEL TRYFAN, *an* 0-6-4*T built in* 1877 *by the Vulcan Foundry and inherited from the NWNGR;* RUSSELL, *a* 2-6-2*T built in* 1906 *by Hunslet Locomotive Co. Ltd, also inherited from the NWNGR; and* 590, *a* 4-6-0*PT built in* 1914 *by the Baldwin Locomotive Works, Philadelphia, for the War Department and later sold to the WHR.*

Of these MOEL TRYFAN *would make the most interesting model, but it is built on the Fairlie principle, which means that you would have to make the cylinder block, motion and coupled wheels as a single swivel unit, like a bogie. This device allows the locomotive to negotiate very sharp curves.*

Drawings are rare. The only ones known are those by R. E. Tustin which appear in J. I. C. Boyd's Narrow Gauge Rails to Portmadoc; *see also* Festiniog Railway, *Vols. I and II, by the same author.*

Gear train

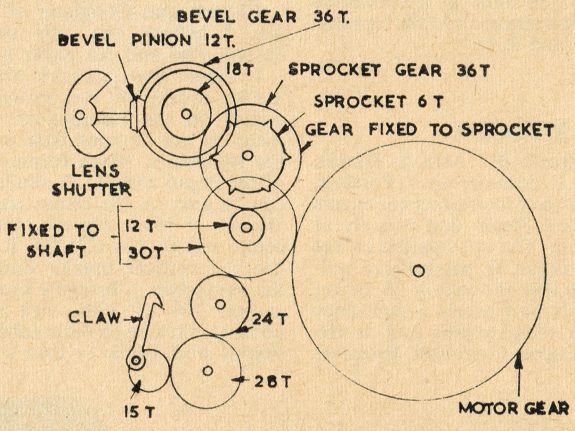
I send a sketch of a train of gears which I want to use in a cine-camera conversion. I would like to know the ratio of the lens shutter pinion and the claw pinion to the sprocket gear wheel. The sprocket has six teeth for carrying the film forward.

Will it be suitable for 16 frames ?—M.A.M., Frimley, Hampshire.

▲ *The claw is designed to advance the film one frame a revolution, and the shutter exposes the film while it is stationary, so that both spindles are geared to run at the same speed. (This does not necessarily apply to projectors, where the shutter may sometimes be run at double speed.)*

If the sprocket has six teeth, it will feed the film six frames a revolution, and it should, therefore, be geared to run at 1/6 of the claw speed. The number of frames a second will depend on the speed at which the claw spindle runs; it should be 960 r.p.m. for 16 frames a second.

Exposure time will depend on the angular opening period of the shutter. Assuming that the shutter rotates in 1/16 of a second and that the aperture in the shutter is equal to 90 deg., the actual exposure period will be quarter the time for a full revolution, or 1/64 of a second.



GEAR TRAIN FOR CINE CAMERA

Model Engineer EXHIBITION

The next Model Engineer Exhibition will be held at the Central Hall, Westminster, opposite Westminster Abbey, from 16-26 August 1961, excluding Sunday. Anyone wishing to enter a model, or other piece of craftsmanship, should write to the Exhibition Manager, Percival Marshall Ltd, 19-20 Noel Street, London W1, for an entry form.

POSTBAG

The Editor welcomes letters for these columns. A PM Book Voucher for 10s. 6d. will be paid for each picture printed. Letters may be condensed or edited

CITY OF TRURO

SIR, I took three photographs, of the *City of Truro* when it was in Taunton pulling the Western Television Exhibition Train on March 3 and 4. After reading Robin Orchard's articles on the *City of Truro*, I thought that the photographs might be of interest.

It may help C.M. of Skipton, Yorkshire [Queries, March 23] to know that the condenser for the ¾ h.p. BTH motor should have a capacity of 130 mfd. It is connected to the two top terminals of the terminal block (T.1 and A.1).

Taunton, Somerset. L. D. HANCOCK.

STEAM MELODY

SIR,—I thank Mr Alan S. Burton and Mr W. E. Summerhayes [Postbag, April 6] for their interesting comments on my article Steam and Melody at Laurel Farm. The information on the Hooghuys organ is particularly welcome, as I had thought it to be an 89-key. It is now nearly a year since I wrote on these organs and at the time the Decca Carrousel Becquart records (LF 1267, 1290) were the only means that I had of drawing a comparision.

Recently an unavailing attempt was made to interest gramophone companies in recording the 98-key Marenghi. Certainly, to do justice to such an organ, an elaborate recording set-up is essential, and this is beyond the scope of the private person. I have heard the Marenghi for many hours. Its volume of sound is so great that something like the Albert Hall would suit it admirably.

Chapell and Company of London are, I believe, the only people in Britain who still cut paper music.

I based my remarks about the smoke uptake of the Savage centre engine on the blanking-off arrangement on the chimney base on top of the smokebox, which forms the base of the organ engine. A similar fitting can be seen on the centre engine *The Wonder* of 1885. On the other hand, centre engine No 657 (ex E. Smith) has the vertical uptake direct from the smokebox. Savage's final centre engine, 903 of 1934, has the side uptake, with a much more substantially shaped steel saddle to take the organ engine. I would welcome further comment on these points, but I believe that certain of the small type from Savage's without the organ engine had a normally positioned chimney.

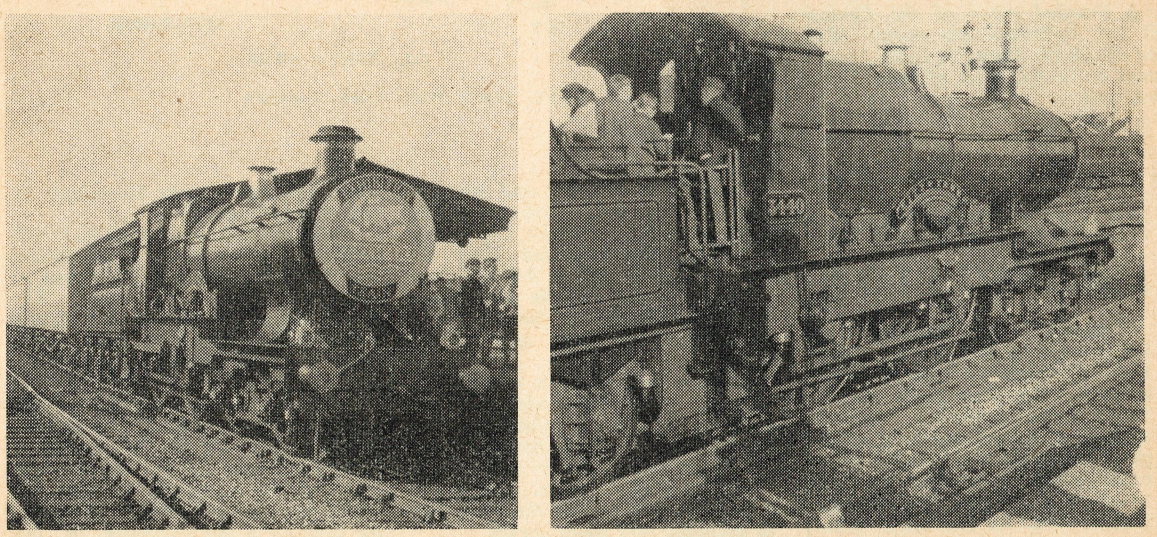
Mr Summerhayes's No 5112 attributed to the Thursford engine seems curious. It is too high for a job number. In fact the No 421 of this engine would put the date at 1887-8. I quoted the date which was given to me some time ago.

I have begun some dimensioned sketches of No 421 for possible use in model work. It is difficult to choose a convenient scale, owing to the very small components in the motion details and the organ engine. One arrives at a massive boiler for a practical working unit. Probably a non-working true scale model to 1½ in. scale would be appropriate.

King's Lynn, Norfolk. ANTHONY BEAUMONT.

ROWHEDGE SHIPS

SIR,—I have been considerably interested in the letters that have appeared on the Thames steamers,



Churchward's CITY OF TRURO *pulling the Western Television Exhibition train at Taunton*

particularly the one in ME of March 16, in which the Rennie Company was mentioned.

G. Rennie and Co. had a yard at Wivenhoe, Essex, during the 1914-18 war (Rennie-Tourists) about three miles down the river Colne from Colchester.

For two and a half years I was employed as a centre-lathe turner at the Rowhedge Ironworks, almost on the opposite side of the river at Rowhedge village. Rennie-Tourists were engaged on trawlers and larger craft, and their slipways faced a fairly wide stretch of the river. The Rowhedge firm specialised in the smaller craft, naval pinnaces, tugs and special war craft, one of which was the fast submarine chasers built of steamed bentwood and fitted with a powerful i.c. engine. I was told that in peacetime a continuous output of passenger steamboats for river work was maintained.

An unusual vessel, was a sternwheeler for military use in the Near East. It was about 60 ft long, drawing 8 in. of water, with a vertical boiler at the bow, and the h.p. and l.p. cylinders fitted horizontally each side of the stern deck. The fixed bladed paddle was about 7 ft diameter. Everything was made as light as possible; the weighshaft for instance, was of tube with solid ends shrunk in. The plates were very thin.

The sternwheelers were not launched but were packed up in crates, after the port and starboard had been painted red and green from a centre line, to be assembled on the site.

Even in war-finish the pinnace and tug engines were a joy to behold. They stood about 7 ft high from the bedplate, with h.p. and l.p. cylinders of about 9 in. and 18 in. bore, and marine type forked connecting rods. The links of the Stephenson valve gear were milled from solid billets, and the rods from the weighshaft were turned from the solid, with ball-ends afterwards milled flat on the sides and bored. Big-end and main bearing bolts were turned from the solid bar, and were screw-cut and polished.

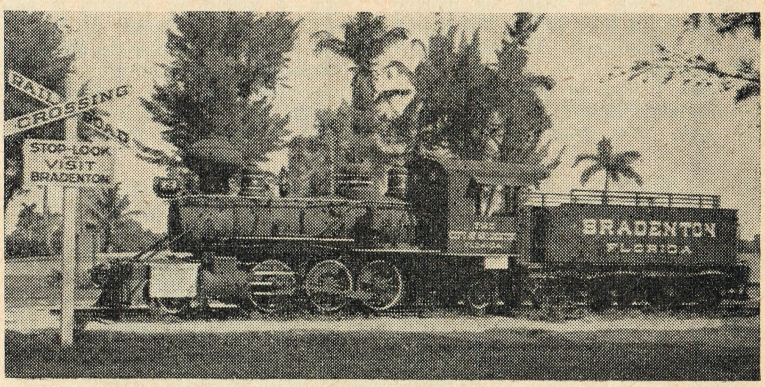
After 45 years I still have piecework tickets for many of the components, including the shafts, gears, and sprockets for the hand steering gear. The company had a very nice machine shop, driven at that time by a large suction-gas engine, which at times, on a frosty morning, was difficult to start. The lighting was direct by a dynamo.

Model engineers can well imagine the skill required to machine a thrust block for a tug and be sure that all the grooves were taking their share of the load.

Brighton, Sussex. G. GOLDRING.

SEEN IN FLORIDA

SIR,—This afternoon, driving south into Bradenton, Florida, I came across the pictured locomotive, exhibited as a publicity stunt on Route 41, a few blocks north of the centre of the town. Since the picture was taken the authorities have surrounded it with a Cyclone fence about 6 ft high, evidently intended to keep small boys and others from the easy access to the footplate provided by the steps. It may have been made to prevent damage suits for possible personal injury to those climbing around the engine.



Presumably to keep the local Tom Sawyers away from the footplate, a fence has been erected around this locomotive on show near Bradenton in Florida

I have been resting and taking it easy on one of the islands near Sarasota, getting lots of sun and about 13 hours' sleep a day.

Birmingham, R. V. HUTCHINSON.
Michigan.

[*This leaves eleven hours for sleeping at night. Lovely, Mr Hutchinson* !—EDITOR.]

LINING TRANSFERS

SIR,—J.R. [Queries, April 6] may care to try making his own lining transfers by drawing them with paint on duplex paper. This paper consists of a stiffish backing faced with tissue which is gummed on the surface. A fairly dense oil paint, such as the Humbrol railway range, can be used to draw the lines with an ordinary draughtsman's ruling pen, beginning with the top colour and finishing with the base, which can often be brushed on as the ruled lines act as very effective brush guides.

To apply the transfer, the tissue paper is peeled from its backing and stuck face down with gold size. Afterwards the tissue paper is soaked off, leaving the paint lines behind.

I cannot say where supplies of duplex paper can be obtained; my own modest requirements are met by offcuts from the edges of Letraset type transfer sheets which I use fairly often. The makers are friendly souls and might be willing to help.

It is quite likely that they would also be able to provide the answer to J.R.'s numbering problem as they market a wide range of letter and number transfers together with a dye outfit for colouring them. Their address is: Letraset Ltd, Artist House, Plough Place, Fetter Lane, London EC4.

London SW18. JAMES SCARLETT.

CHUCK JAWS

SIR,—In Queries of March 30, D.T., asks how to treat a self-centring chuck whose jaws close considerably off centre. An alternative to your method of truing may serve.

Turn up between centres a parallel mandrel large enough in diameter nearly to fill the hole in the chuck body. Pass it through the chuck and close the drill jaws firmly on it, jaws towards the headstock. Place the mandrel and chuck between centres and skim out the recess for the backplate; this will make it concentric with the jaws. The face which abuts on the back-plate should also be skimmed true. It may be that only one of them is "out" but it is as well to be sure.

You can then turn a new register on the backplate and you may need to draw over the holes for the fixing screws. I should drill three more holes in the backplate for the fixing screws, making them 1/32 in. larger than the screws, and leave the backplate register a really slack fit. I should chuck a stub of $\frac{1}{2}$ in. or $\frac{5}{8}$ in. ground silver steel and tap over the chuck till the stub clocked true. Then I should tighten the screws, and clock again.

It is, of course, possible that the chuck jaws are worn bell-mouthed, in which event grinding would be required. The scroll may be strained but if it is, the jaws will almost certainly be very stiff in places.

I have taken ME from the first and still look eagerly for Thursdays.

Birkenhead A. E. HEPWORTH.

[*Is Mr Hepworth our oldest reader?* —EDITOR.]

KIPLING'S NAVY

SIR,—I was interested in the article by R. S. Vinning, Kipling's Navy Needed Speed [ME, February 2].

ME had not published such complete drawings of these old marine engines for a long time. The model in the Edinburgh Museum looks magnificent.

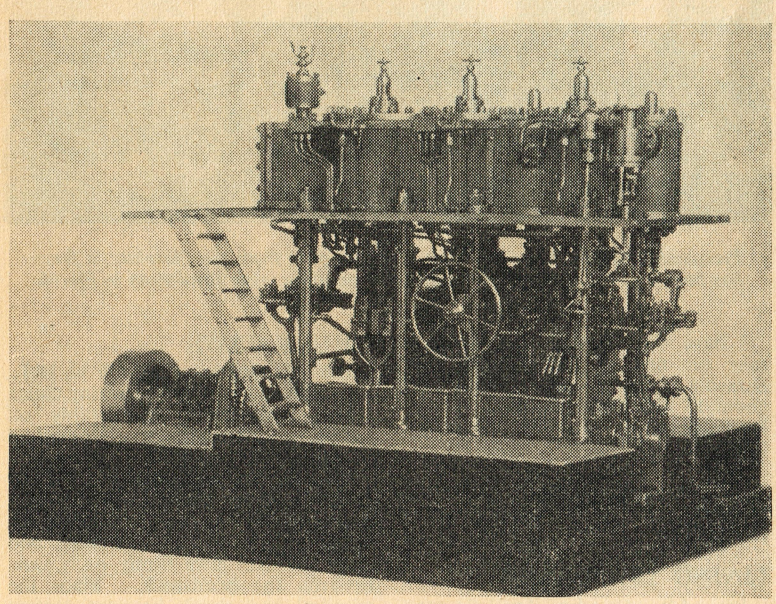
When I was an apprentice in a Merseyside shipyard during the 1914-18 war, two small turtle-decked torpedo boats, HMS *Dee* and HMS *Dove* used to come into the wet dock every few days. As far as I can recollect, they had engines as shown in ME of February 16 [' Hell on a Ten Foot Scale ', page 195].

I remember going down the engine room of a cruiser in for repairs with the same type of engines. What impressed me most was that the port and starboard engines were separated by a bulkhead. Standing on the floor-plates with one's back against this partition you had the feeling of being only inches away from the massive cranks and big-ends—with only a handrail to save you. To be in this cramped engine room in a heavy sea must have been hell.

The first model which I exhibited at the ME Exhibition in 1934, had some of the style I admired so much. I had built it with the ordinary Stuart-Turner triple expansion castings—which are still made, I believe.

It has been in the Liverpool Museum for the last 27 years.

Greenford, Middlesex. JOHN A. KAY.



John A. Kay exhibited this model at the ME Exhibition in 1934, *and it has been in the Liverpool Museum ever since. As an old Merseyside apprentice he enjoyed Lieut-Colonel R. S. Vinnings's article on speed in Kipling's Navy*

YACHT RESEARCH

SIR,—I would be grateful if you could correct a report in Smoke Rings of March 30 that the Palisades Foundation of Pennsylvania, on the recommendation of my friend Dr Lamont, had made a further grant to the Southampton University for yacht research for the Red Duster Syndicate. This grant has nothing to do with the Red Duster Syndicate. It is for general yacht research to benefit all yachtsmen, with the idea of gaining information on the correalation between model and full-scale results.

The radio-controlled model work is planned to be done at Poole when the University is ready with its tank, full scale craft and model. Meanwhile Mr Curwen and I assisted by Mr Hogg when he finds time from his normal work, will be carrying out similar tests using a 1/3 scale model of my full-scale XOD keel boat, and the full-scale craft itself.

We are also trying out the sails' airflow pattern, and making force measurements on a large model sail testbed we have in operation. It will be interesting to see where model and full-scale agree or differ, provided that we are able to measure the full-scale sail's thrust accurately by the method which we propose to use. Model sails are already being accurately measured on a Twelve Metre rig, while illuminating airflow patterns are being photographed showing, by wool threads, where the air goes.

These tests cover a large overlapping rig, whilst the XOD sails we have will cover the very slightly overlapping type. Some rather surprising results are already emerging in complete variance with the usual small wind-tunnel " solid " metal sails employed. Our rigs are around 8 ft 6 in. tall and with free winds flowing on to them.

Bournemouth. C. E. BOWDEN.

[*Sorry about that slip, Mr Bowden. Vulcan based his Smoke Ring on an authority who is held in high regard by ship modellers.*—EDITOR.]

BIG OR LITTLE

SIR,—Never in my life have I heard the term " high or low wheel." The term that I think Mr M. Speary [Postbag, March 30, Brown and May traction engines] is searching for is " big or little wheel."

I have been reading ME for a year now. May I commend you on its high standard of quality ?

Haslemere, Surrey. C. COXALL.

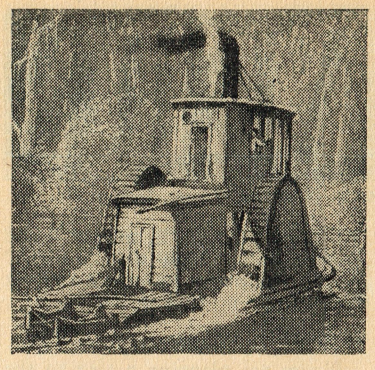
BIG MAMA

SIR,—The *Sprague*, which is very much alive to date, made her last commercial trip 5 March 1948 [Some Stern-wheelers of the Middle West, ME, February 23]. She was sold by the Esso Standard Oil Company to the City of Vicksburg, Mississippi in the same year. Thus " Big Mama " was saved from the junk pile.

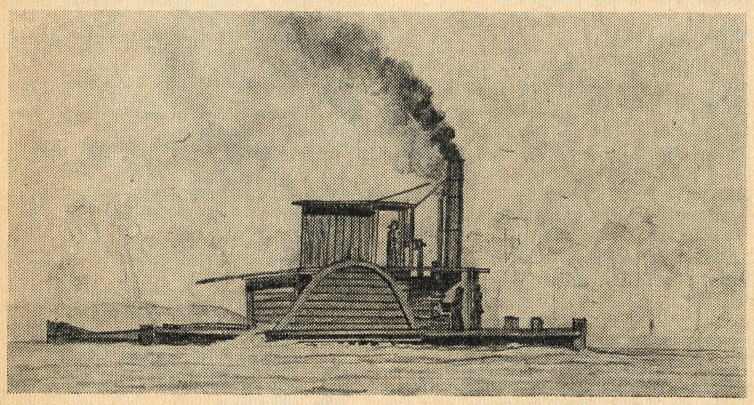
In 1959, when the Pittsburgh Bi-Centennial Association borrowed the *Sprague* from Vicksburg for its celebration, over $100,000.00 (£35,700) was spent on repairs and renovations. An electric motor and gear device was installed to make engines and sternwheel move slowly for demonstration. She is at present on display in Vicksburg, Mississippi.

Beaver Falls, Pennsylvania. CLYDE H. LIGHTFOOT

SIMPLE STEAM TUG AT SILVER SPRINGS



IN the days when there was a demand for steam power to move timber and goods on sluggish rivers and on inlets of the sea, you might have seen in Florida a steam tug which must have been the cheapest ever built. It was a pusher tug, used at Silver Springs where the water was so shallow that the barges or rafts of timber were pushed gently to the bank.



The tug is illustrated in *Pictorial Chronicles of the Mighty Deep* (Frederick Waine, London). While the book is undated, its general appearance suggests that it was published in the 1885-1890 period.

An engine on the deck drove the side wheels. The whole vessel was built of common lumber and the deckhouses were covered with boards.

Observe the rudders, braced together and worked from the pilot-house above the paddleboxes. They had fins so that they could be clearly seen—just like the fins on modern American cars. I wonder if the car designers had seen this engraving in *Pictorial Chronicles of the Mighty Deep*?

From the engraving I have tried to construct an elevation showing how the tug must have appeared in motion. A working model of it would look very curious on a pond; it would need a compact spirit-burning boiler, for the modeller would not like a mass of soot from the flames, as in the second illustration.

See the long battens lying on the deck and the top of the engine room so that a letter or packet could be tied to the end of one of them and passed to the shore.

The paddleboxes and fenders came very low down, and the water was discharged over the tops of the sponsons. It would not have done to allow any room at the rear of the boxes for floating roots and branches to get into the path of the wheels in going astern.

Such vessels of local design have now disappeared.—H. H. NICHOLLS.

FOR YOUR BOOKSHELF

The British Journal Photographic Almanac, 1961. (*Greenwood and Co. Ltd*, 8*s*.)

For the expenditure of eight shillings annually, the serious photographer can keep abreast of events.

Packed within the 600 pages of this year's *BJ Photographic Almanac* are formulae and tables dealing with the most important aspects of ciné and still photography.

There are informative articles on colour finishing, flare and its effects, and the type of camera for the job. Details of a large number of new items are listed and considerable space is given to a table outlining the properties and quoting the formulae of a great many chemicals used in everyday photography.

For several years successive editions of the Almanac have occupied my darkroom shelf.

I have thanked their presence on many an occasion when a tricky problem has arisen at an hour when most likely sources of information are tucked up snugly in bed.—L.B.H.

Formula Junior Competition Cars. (*Temple Press*, 7*s*. 6*d*.)

Formula Junior for small racing cars achieved international status in 1959.

The formula originated with Lurani, whose idea it was to provide facilities for drivers to gain racing experience with a view to proper Grand Prix motor racing later.

The size of engine adopted determines the minimum permissible weight of the complete car, and the formula allows the use of numerous British 1,000 c.c. engines, among which BMC and Ford are prominent.

In this book, the new formula, its already eventful history and its governing rules are fully described, while more than 80 different makes of Formula Junior competition cars are illustrated and described.

This is an excellent publication for all interested in motor racing. The illustrations and drawings are of high quality.—R.M.E.

CLUB NEWS

Send news and notices to The CLUBMAN, 19-20 Noel Street, London W1.

MYA's SUMMER

As usual the Model Yachting Association is holding open championships for yachts of various classes. The M class regatta will be held on September 9 and 10 at the famous Hove Lagoon. For competitors the closing date is August 12 and the fee is 10s. Last year the championship was won for the second time by Mr R. J. Burton of Clapham with his *Una*. Is he going to complete the treble ?

The 6-metre event takes place on June 24 and 25 at another popular yachting centre, Bournville. Entries accompanied with the 10s. fee should be sent before May 27. Last year the winner was Mr C. Edwards with his *Helvig*.

On August 13 we have the International A class championship at Fleetwood. Entries with the £1 entry fee should be sent before July 15. Last year's winner was R. Gardner of Gosport with his yacht *Nocturne*.

In 1960 the Q class competition for radio control was not run. This year it is back again—on Saturday and Sunday next at Surbiton. The present reigning champion is Mr T. G. Carrington-Wood of the IRCMS with his *Vanessa*.

Finally, we come to the popular 10-rater class. The event is at Gosport on May 20-22.

Last year's successful contender was Mr T. Knott of Clapham with his yacht *Ashra*.

Gosport is also the scene of the Little Portugal Cup contest on July 2.

BLENHEIM NATIONAL ?

Last year I had to announce that Birmingham SME was closing its delightful Campbell Green track. It was, I felt, a pity that the National Rally should die with it. But perhaps it will not die after all.

I have received a letter from Mr A. W. G. Cleaver, secretary of the Witney and West Oxfordshire SME. The society track in the grounds of Blenheim Palace is nearly finished and the society feels that, with three acres of ground at its disposal and a 1,320 ft long track, it would be a good thing to hold the National Rally at Blenheim until such times as Birmingham could take over the reins again.

Mr Cleaver has communicated with the Birmingham SME, and has found it enthusiastic. What do you think ? Would you prefer to have a rally at Blenheim or no rally at all ?

NORWICH MODELS

If you are planning a visit to the Norfolk Steam Engine Club Rally at Woodton on Whit Monday, I have news of another attraction for you. Besides all the usual fun and excitement created by the traction engines and steam wagons, there will be an exhibition of high quality model engineering by members of the Norwich and District SME.

Mr A. Hoskins, secretary of the Norwich society says that the society's excellent track at Eaton Park, Norwich, will once again be open this year. Visitors are always welcome.

Mr A. Hoskins lives at 5 Hellesdon Road, Norwich, Norfolk.

NEW TRACK

Another new track is about to be built. It will be the grounds of Pitfield House, Newcastle-under-Lyne, the home of the North Staffordshire Model Society. Plans have already been submitted to the local council and have been approved. Construction should take at least a year.

Over the past year the society has attracted a number of new members. Interest is far from waning, secretary J. Lynch tells me. He asks me to remind readers that the society is holding its spring regatta at Alton Towers on Sunday. You can write to him at 27 Cemlyn Avenue, Blunton, Stoke-on-Trent, Staffordshire.

RALLY ROUND

May 13 Andover Rally. *Traction engine rally at Finkley Manor Farm, Andover, organised by the Andover MES. There will also be a model engineering exhibition.*

May 14 Birmingham Rally. *Traction engine rally at Newhall Street, Birmingham, organised by the City Museum and Art Gallery. There will also be a live-steam demonstration of stationary engines in the museum.*

May 20 Somerset Rally. *Traction engine rally at Shepton Mallet, 5 miles SE of the City of Wells. Reached by the WR of British Railways.*

May 21-22 Beaulieu Rally. *Traction engine rally at the home of Lord Montagu of Beaulieu. Beaulieu is in Hampshire 6 miles NE of Lymington and 2 miles NE of Beaulieu Heath.*

May 22 Shipton Rally. *Traction engine rally at Shipton-by-Beningborough, Yorkshire, 5½ miles NW of York.*

May 22 Great Wymondley Rally. *Traction engine rally at Great Wymondley which is halfway between Hitchin and Stevenage on the main A602.*

May 22 Woodton Rally. *Traction engine rally at Woodton Old Hall, Woodton, 5 miles from Bungay. Organised by the Norfolk Steam Engine Club.*

June 3 North Hykeham Rally. *Traction engine rally at North Hykeham which is 3½ miles SW of Lincoln*

June 10-11 Beaulieu Rally. *Rally at the home of Lord Montagu and headquarters of the Montagu Motor Museum. Beaulieu is in Hampshire 6 miles NE of Lymington and 2 miles NE of Beaulieu Heath. Organised by the Historic Commercial Vehicle Club.*

June 17-18 Revesby Rally. *Traction engine rally at Revesby Abbey, Bolton.*

June 17 Appleford Rally. *Rally at Appleford, 3 miles SE of Abingdon, Berks.*

July 1-2 Alton Towers Rally. *Rally at Alton Towers, 8 miles NW of Uttoxeter, Staffordshire. Organised by the North Staffs Traction Engine Club.*

July 15-16 Rempstone Rally. *Rally at Rempstone, 3½ miles NE of Loughborough.*

July 22 Redruth Rally. *Redruth is 9 miles SW of Truro, Cornwall.*

CLUB DIARY

Dates must be sent at least four weeks before the event

May 4 Croydon SME. Illustrated lecture on the traction engine by Mr C. R. Randell at the Lichfield Club, Lichfield Road, East Croydon.

May 4 Sutton MEC. Track work.

May 4 Eltham and District Locomotive Society. Annual general meeting at the Beehive Hotel, Eltham, at 7.30 p.m.

May 4 Huddersfield SME. Talk and demonstration by Mr G. Cabeley on Radio-Control at the Highfield HQ at 7.30 p.m.

May 5 Rochdale SMEE. General meeting at Loa Hall, Smith Street, Rochdale, at 7.30 p.m.

May 5 Warrington and District MES. Meeting at Earlestown.

May 5 North London SMEE. Annual general meeting at the Gas Office, Station Road, New Barnet.

May 5 Coventry MES. Visit to Fort Dunlop.

May 6-7 City of Leeds SMEE. Open day at Temple Newsam.

May 6 Bristol SMEE. Talk on colour film processing by Mr R. Mason, at the Games Room of the YWCA.

May 6 Cambridge and District MES. Open day at the track off Fallrooke Road, Cambridge.

May 6 SMEE. Electric welding demonstration at 28 Wanless Road, SE24, at 2.45 p.m.

May 7 Brighouse and Halifax SMEE. Club open day at Ravensprings Park, Cawliffe Road, Brighouse.

May 7 Malden SME. Track day at Cloygate Lane.

May 7 North London SMEE. Driving instruction at Arkley.

May 7 Cambridge MES. Visit to the Cambridge University Railway Club.

May 7 Birmingham SME. Invitation to the Brighouse SMEE at Ravenspring Park, Brighouse.

May 8 Leicester SME. Talk on North American Rail Roads by J. Mawby.

May 8 Historical Model Railway Society. Lecture on pre-group signals by Mr E. I. Vaughan at the Keen House, Calshot Street, London N1, at 7 p.m.

May 9 City of Leeds. Open day at Temple Newsam.

May 10 Harrow and Wembley SME. Talk by Mr Ross of the Wembley SMS on ship models at Heathfield School, Harrow, at 8 p.m.

May 10 Grimsby SMEE. General meeting at Clubroom at 7.30 p.m.

May 11 Grimsby SMEE. Boat building instruction at 7.30 p.m.

May 11 Sutton MEC. AGM and craftsman of the year competition.

Advertisements, with remittance, should be sent to Classified Advertisement Department, Model Engineer, 19-20, Noel Street, London, W1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 31.

★ Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of Box No. 2s. 0d. extra.

★ Displayed Classified Advertisements. Trade 35s., Staff 45s., per single column inch. (Column width 1⅞ in.) (Series discounts on application.)

CLASSIFIED ADVERTISEMENTS

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1.

Myford ML7 and Super 7 Lathes for prompt delivery. Cash or terms.—VICTA ENGINEERING, Maidenhead, Berks.

Eagle Surface Grinders from £188. Early deliveries. Cash or terms.—VICTA ENGINEERING, Maidenhead, Berks.

New Marlow Vertical Mills, 22" × 6½" motorised, from £210. Cash or terms.—VICTA ENGINEERING, Maidenhead, Berks.

STAINLESS STEEL

Sheet, rod, bar, tube, wire, etc., from stock, cut to size.

TAYLOR STAINLESS METALS LIMITED

Buckingham Avenue, Slough, Bucks.

Phone: Slough 23951

Lathe Centres No. 2 MT. (all) 5s. each, carbide tipped 10s. each. Revolving centres, 70s. each, C.W.O.—ACORNTOOLS, 610, High Road, W.4. CHIswick 3416.

Target Milling Attachment, vertical slide, as new. Offers.—5, Oaky Balks, Alnwick, North'ld.

Cytringan Welders 180 amp., £35, brochure from—PICKHILL ENGINEERS, Thirsk, Yorks. Sinderby 234.

Wanted. Cabinet Stand for ML7 Lathe. —WHITE, "Laurelhurst," Possingworth Close, Sussex.

Brand New Ball Races, ⅛" i.d., ⅜" o.d., 1s. each or 10s. 6d. dozen. Postage 6d.—ATKINS, 17, Applegarth Lane, Bridlington, E. Yorks.

Zyto B.G.S.C., ¼ h.p., s.p., c/shaft, s/c chuck, standard equipment, £27.—ALLEN, 49, Ashbourne Road, Ealing, W.5.

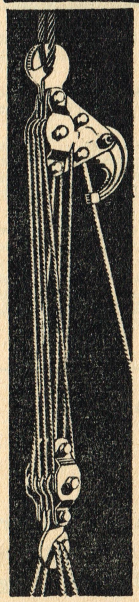
For Sale. Model engineer's workshop. Please send for details, inspection invited, £150 or near offer. Buyer collects.—Box No. 9939, MODEL ENGINEER Offices.

INTRODUCING A NEW PORTASS LATHE

3⅜" × 16" B.G.S.C. bench lathe complete with faceplate, catchplate and backplate, changewheels, etc., flat or vee drive, £28 15s. Complete satisfaction or remittance refunded in full. Ex-works write:

CHARLES PORTASS & SON,
Buttermere Works, Sheffield, 8.
Est. 1889. Cash or terms.

HALTRAC
AUTOLOCK
MIDGET HOIST



A pocket-sized hoist for a thousand and one lifting and pulling jobs.

1,000 lbs. Breaking Strain Weighs 1¼ lbs.

Safety Autolock (8:1 ratio) holds at any height. Rust-proof. Nylon pulleys and nylon cord.

Model 44a: 87/6

Model 34 without Autolock (7:1 ratio): **57/6**

Available from all good Stores, Ironmongers, Yacht Chandlers, Halford Branches, etc., or from:

HALTRAC LTD.
Bourne Works,
Weimar Street, S.W.15.
Tel: PUTney 2263/4.
Trade enquiries also invited.

Wanted. Vertical Slide Suit ML7, M.E. dies, boiler material, "Lassie," "Maisie," "Maisie" book, drawings.—MCDONALD, 12, Bath Street, Stonehaven, Kincardineshire.

Wanted ML7 with Equipment in good condition.—10, Cleave Avenue, Farnborough, Kent.

Pultra Lathe Wanted. Particularly bed and headstock. Please send full details to —PEALING, 11, Arron Street, Ellerslie, Auckland, N.Z.

Wanted. Myford ML7 or Atlas lathe, for engineer's private workshop. Only good machine considered.—EDGWARE 0249.

Cowell 3MD Drilling Machine, new, complete with belt, guard and ⅜" Jacobs chuck, £14. Drummond 3½" × 16" lathe, motorised, 240/1/50 with Myford clutch, vertical slide, 3-jaw Burnerd chuck, reversing switch and other equipment, v.g.c., £25.—BIRD, 3a, Baker Street, High Wycombe.

Mail Orders, New. 1 lb. brass screws, 2 B.A.-8 B.A., different lengths, 7s. 6d. 4 B.A. hex. bolts cadmium various lengths, 144 plus 144 nuts, 144 washers, 9s. 6d. Above 2 B.A., 10s. 6. 30 H.S. drills, 31-60, 15s. 20 H.S. 61-80, £1. 40 thread taps, 5/32", 1/16", 7/32", ¼", 2s. each. 40 t.p.i. dies, 5/32", 3/16", 7/32", ¼" each, 3s. 6d.—M. SHAW, 7, Hengist Street, Manchester 18.

Atlas Incomplete 5" Bench Lathe, £10. Odd lathe parts cheap old flat belt, bench drill, drill 30s. Belt grinder 15s., vice 15s.—PIKE, 36, Brenthouse Road, Hackney.

MODELS AND FITTINGS

For Sale or Exchange 2" scale traction engine for smaller or 3½" gauge locomotive with cash either way.—16, Osborne Road, Levenshulme, Manchester, 19.

New Electric Motor, 3-6 v., pulley, spares, brushes, 7s. 6d. Model power machine saw, removable blade and adjustable vice, 3s. 6d. The two 10s.—PATRICK, 201, Bardolph Street, Leicester.

"ROB ROY"

Send S.A.E. for detailed list of castings for this fine 3½" gauge loco.

36-page Catalogue of Blueprints and castings; Price 1/-. 38 Locos illustrated.

KENNION'S
2 Railway Place, Hertford, Herts.
Phone: 2573

Wanted. Steam Locomotive and Tender, "O" gauge.—449, Redditch Road, King's Norton, Birmingham.

2½" "Dyak," needs boiler, rolling stock, dismantled locomotives. Sale or exchange lathe, tools or T.E.—HICK, Dalkey, Dublin, Ireland.

Wanted. "Tich," 3½" gauge, running order, £10.—FOULKES, "Haulfryn," St. Georges Drive, Deganway, N. Wales.

Starting "Springbok"? Main, bogie frames shaped, drilled; buffer, drag beams coupling rods milled, stretchers, cylinder pattern, £2. Quantity H.S. side and face milling cutters cheap, stamp list.—RICHARDS, Llanddulas, Abergele.

LIVE STEAM SERVICES

Castings, drawings, materials for "Springbok," "Rob Roy," "Firefly," 3½" and 5", and "Sirena." S.A.E. for list. State locomotive.

THOMAS & AMEY
422, Upper Richmond West, East Sheen, S.W.14.
PROspect 0686.

ELECTRICAL

A.C. Motors, Self-start induction 200/250 v., 50 cycles, 1-phase, 1,425 r.p.m., ¼ h.p., 72s. 6d., 1/3 h.p., 97s. 6d., ½ h.p., £6 5s. Perfect and guaranteed, carriage England, 2s. 6d.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.1. RELiance 1412/3.

Synchronous Clock Motors. 200/250 v., a.c., 50 c. with geared mechanisms. Various types, large stock, 7s. 6d. each. Quantity reduction.—TRADEX METER COMPANY LTD., 67, Maple Road, Surbiton, Surrey. Tel.: ELMbridge 2234/5/6.

Self-starting Synchronous Clock Type Motors, 200/250 volt, 50 c., 3s. 6d. each.—GRAHAM LTD., 73, Acre Road, Kingston, Surrey. KIN 0075.

SITUATIONS

A Vacancy Exists for a prototype and development modeller in a well-established plastic toy factory. Twickenham area. Excellent opportunity and prospects for a model maker with initiative.—Phone : POP 2293.

A Vacancy Exists for a miniature railway driver at the Strand, Gillingham, for the season commencing in early May and ending in mid-September. Winter employment will be made available to suitable applicant. 42 hours per week, rate of pay 4s. 6d. per hour, plus bonus at end of year according to number of passengers carried. Applications should be forwarded to the—BOROUGH ENGINEER, Municipal Buildings, Gillingham, Kent.

Wanted. Driver for running miniature railways, steam, petrol or diesel, capable of maintenance. Opening 1st May and running daily. State wage, age and ability.—Box No. 9942, MODEL ENGINEER Offices.

CARS, ROAD VEHICLES, ETC.

For Sale. Wallis and Steevens 10-ton steam roller, excellent condition, boiler certificate, pressure as new, p.s.i., new tubes, piston rings and piston valve rings, new spur wheels, and top motion brasses, scarifier, sprinklers, full set curtains, 200 gallon water service trailer with tool box. Owner retiring due to health, £250 o.n.o.—WALKER, Hook Green, Meapham, Kent. Tel.: 3286.

Ransomes Sims and Jefferies Traction Engine, pertect condition, clean, £350. Also Morris commercial 1928, £20.—P. ATHERTON, Willow Farm, Twyford Lane, Bold Widnes. Phone : Widnes 2880.

PHOTOGRAPHY

Photographic Service for Modellers. Developing and printing, colour printing from colour negatives. Models photographed.—RENDELL & WILSON, 176A, Ashley Road, Hale, Altrincham, Cheshire.

HOLIDAYS

Devon. Bed, breakfast, evening dinner. Farm produce, comfortable rooms, lounge, television. Easy reach river, sea, moors.—BROMING, "Neerarch," Totnes. Tel.: 3148.

Ocean Breezes Guest House, Barnoon, St. Ives, Cornwall, overlooking Porthmeor Beach, two minutes town, adjacent car park. Breakfast, evening meal, moderate charges.—St. Ives 587.

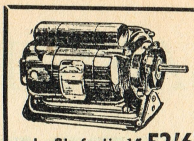
GENERAL

Wanted. Alco steam chargers, ex-Adm. surplus with Sirius engine. Also compound marine engine, 30-40' hull, perfect condition. Also 4¾" gauge loco.—DAVID ROSE, 4020 Longridge, Sherman Oaks, Calif., U.S.A.

Wanted. Horizontal Mill-type Stationary Steam Engine with cylinder dia. approx. 2½" to 3½", side-crank design preferred. Please send full particulars to—T. MIDDLETON, 1508 Bel-Aire Ave., Aberdeen, Washington, U.S.A.

Make Your Own Musical Boxes. Swiss musical movement and our own make of box kits. Send 6d. in stamps for lists and diagrams. —MULCO LTD., 87, Cambridge Road, London, N.W.6.

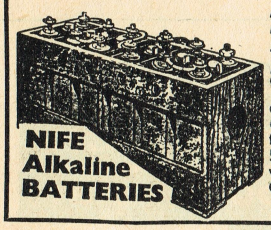
All About Model Aircraft by P. G. F. Chinn. A new book by a world famous author published in magazine size format. 112 large pages are packed with up to the minute information on the latest methods of building and flying. The 24 chapters contain over 400 illustrations which include 350 "how to do-it" photographs. 6s. from your bookseller or 6s. 6d. post paid from Percival Marshall and Co. Ltd., 19-20, Noel Street, London, W.1. (U.S.A. and Canada $1.50 post paid.)



1/6H.P. Electric MOTORS

Capacitor Start. Single Phase, excellent condition. 1,425 r.p.m., 200-250 v. A.C. Flexibly mounted. Shaft dia ½" **52/6** (Carr 7/6.)

MARBLE ARCH SUPPLIES
286-302 CAMBERWELL RD S.E.5



Many other motor bargains

8/- Cell

or 48/- for 6 cells crated free.
50 A.H. 1·2 volts per cell.
Carr 2/- (1) 12/6 (6)

NIFE Alkaline BATTERIES

Govt. Surplus. S.A.E. for list.—S. MIDGLEY, Richmond, Hebden Road, Haworth, Keighley.

Compressor Equipment, aqualungs, miscellaneous items, etc.—PRYCE, 157, Malden Road, Cheam, Surrey.

Permanent Accommodation. Retired person or couple, model engineering facilities, centrally heated Devonshire mill, picturesque setting.—Box No. 9938, MODEL ENGINEER Offices.

Country Cottage, secluded, quiet situation, 5 rooms, bathroom, etc. Cultivated garden and small orchard with a 2" scale railway, locomotive, cars and equipped workshops. Garage, out-houses, Burnham district. Full particulars from—DAVID E. WILLIAMS, Old Bank House, Broadway, Wickford, Essex.

Warship Drawings. Lines and full detail. Sample and price list available from—NORMAN OUGH, 98, Charing Cross Road, London, W.C.2. (Temple Bar 3926). 3d. stamp please.

Patents Business Man requires to purchase or manufacture under licence. Write giving full particulars and price, confidential. —Box No. 9940, MODEL ENGINEER Offices.

Welsh Highland Railway. Anyone who is interested in its restoration, please send for details to—HONYCHURCH, 111, Oakfield Road, Shrewsbury.

Projectors. Home assembly kits from £6 2s. 6d. Fan base kit £3 7s. 6d. Opticals : screens. S.A.E.—MARSHALL SMITH LTD., 64, Norwich Avenue, Bournemouth.

Simplified Stereoscopic Photography by C. W. Wilman, B.Sc., A.R.P.S. Any moderately competent photographer can produce stereograms showing depth and form after reading this book. It explains the basis of stereoscopy, taking stereoscopic photographs, viewing apparatus, materials, methods, trimming, masking and mounting, colour stereoscopy, etc. There are numerous illustrations. 5s. from your bookseller or 5s. 6d. post paid from Percival Marshall and Co. Ltd., 19-20, Noel Street, London, W.1. (U.S.A. and Canada $1.25 post paid.)

BACK NUMBERS

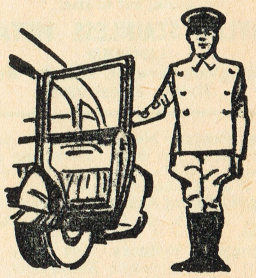
For Sale. 684 "Model Engineer" between 1516-3005. Offers.—Cox, Ocean Breezes, Barnoon, St. Ives, Cornwall.

Approx. 800 Copies "Model Engineer," 1946-1961, clean. Best offers.—PEPPER, Birdwood Road, Cambridge.

"Model Engineer," January to December for 1951, 1952, 1953, 1954, 1956, 1957, January to June 1955, July to December 1950, 26 copies 1931. Offers please.—WICKS, 56/58, Peabody Road, Farnborough, Hants.

Approximately 3,000 Copies back numbers M.E. for sale. Offers.—A. HICKS, 67, Malmesbury Road, Morden, Surrey.

LIVE IT UP A LITTLE!



Treat yourself to an annual subscription to *Model Engineer* so as to ensure it reaches the breakfast table regularly and unfailingly through the post on the day of issue. The circulation of *Model Engineer* is rising and copies sell out very quickly. Be absolutely certain of getting yours regularly by filling in and posting back the form below.

SUBSCRIPTION ORDER FORM

To Percival Marshall & Co. Ltd., 19-20, Noel Street, London, W.1

Please send MODEL ENGINEER for twelve months. I enclose P.O./Cheque for 65s. (U.S.A. and Canada $9.25).

NAME.....
(Block letters please)

ADDRESS.....

.....

ME QUERY COUPON MAY 1961

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS LTD., Cordwallis Works, Maidenhead, Berks. and published by PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1. Registered for transmission by Magazine Post to Canada including Newfoundland.

PRECISION GEARS

Spur Gears — 24-100 D.P.
Bevel Gears Mitre & Ratio,
Worm Gears and Reduction Boxes,
Crossed Helical Gears — Racks,
Ground Shafting — Collars — Ratchet Wheels

Send for complete list. *Phone:* 20231-2

Made by **S. H. Muffett, Ltd.** Estd. 1920

PRECISION PRODUCTION ENGINEERS
Mount Ephraim Works, Tunbridge Wells

WE SPECIALISE

IN EVERYTHING FOR THE MODEL ENGINEER

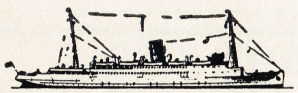
MYFORD, ZYTO, UNIMAT, WAKEFIELD LATHES, BRIDGES, WOLF, B. & D. AND SELECTA HOMEMASTER UNITS

" Caley " universal cutting oil **2/-.** Post 1/-.
" Caley " super steam oil **2/-.** Post 1/-.
" Caley " steam packing $\frac{1}{16}$ rnd. **1½d.** foot.
$\frac{1}{8}$ rnd. **3d.** $\frac{1}{8}$ square **7d.** foot.

PATTERNMAKING **CASTING** **MACHINING**
NO CATALOGUE MEANTIME S.A.E. ENQUIRIES

CALEDONIA MODEL CO.
478 ARGYLE STREET, GLASGOW, C.2.

PLANS OF FAMOUS SHIPS



We specialise in really authentic plans of famous ships, both Sail and Power. These drawings are suitable for the construction of first-class scale models—not toys.

Fully illustrated catalogues can be supplied as under:
SAILING SHIP (C) 1s. 6d., plus 4d. postage.
POWER CRAFT (C) 9d., plus 2d. postage.

from All Leading Model Dealers or **BALTONSBOROUGH GLASTONBURY SOMERSET**
UNDERHILL PLANS

METALS AND ACCESSORIES

Send now for our FREE LIST including :—
ALUMINIUM, BRASS, COPPER, STEEL, ETC.

Angle, Sheet, Tube, Foil, Strip, Channel, Rod, Bar, Wire, Moulding, Etc. Tin Plates, Silver Steel, Expanded Metal, Blanks, Rivets, Springs, Etc. Tools, Drills, Taps, Dies, Screws, Etc. Formica, Perspex, Pegboard, Paxolin, Ebonite, Curtain Rail and Rod, Adhesives, Etc., and many other items for use in Home, Workshop, Etc.

LARGE or SMALL Quantities **COMPARE our PRICES**
MAIL ORDER SERVICE **IMMEDIATE DESPATCH**
Personal Shoppers welcomed. Hours: 9-6 (Wed.: Half-day)

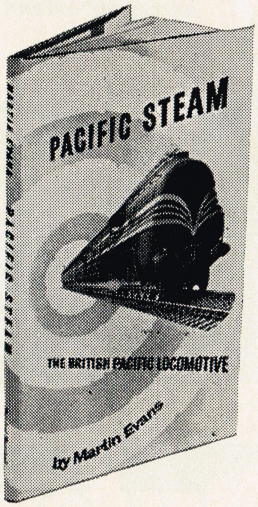
CLAY BROS. METAL SUPPLIES LTD.
6b Spring Bridge Road, Ealing, W.5
Phone: EALing 2215
2 min. Ealing Broadway Station, Opposite Bentalls.

A NEW BOOK

Pacific Steam

The British Pacific Locomotive

By MARTIN EVANS



Thirty-five photographs, five tables of information include leading dimensions, steaming rates, coal and water consumption, speeds on runs, &c.

Foreword by Mr. R. A. Riddles; formerly Chief Engineer of British Railways

ONE of the most successful types of express locomotive to be used in Great Britain over the past thirty years has been the Pacific. Pacifics were designed and built on each of the four main line companies by the Chief Engineers in charge. The basic 4-6-2 design was modified and experimented with, as different classes of locomotive were built for different work.

Martin Evans has spent a lifetime studying locomotive design and construction and in his present book, he has skilfully combined technical data with exciting accounts of the different types of Pacific, built by such famous engineers as Sir Nigel Gresley, Sir William Stanier, Mr. O. V. S. Bulleid and Mr. R. A. Riddles.

Pacific locomotives have hauled such famous express trains as " The Coronation Scot," " The Flying Scotsman " and " The Golden Arrow " and have been used in attempts on the railway world speed record. A Pacific was shipped to New York to represent British Railways at the 1939 New York World Fair and a Class 8 Pacific, *Duke of Gloucester*, was the last express passenger locomotive to be put into service on British Railways.

The Great Bear, Victor Wild, Flying Scotsman, Papyrus, Duchess of Hamilton (later to be exhibited in the United States as *Coronation*) all figure in these pages as do *Britannia* and *Duke of Gloucester*, the last of a noble line.

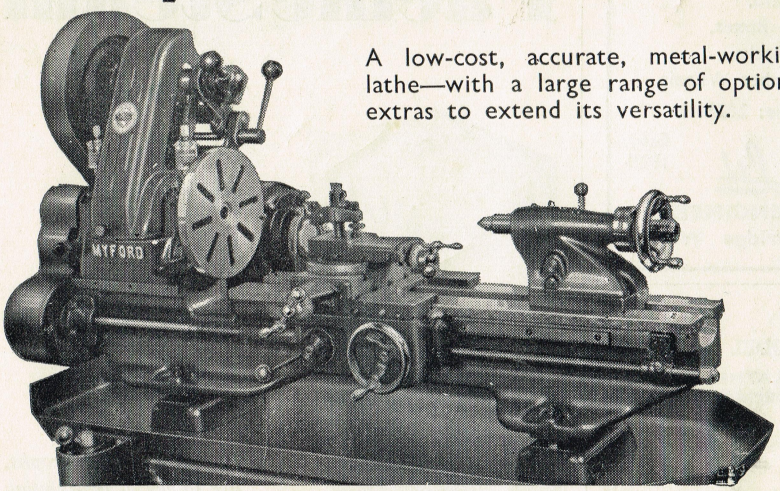
12s. 6d. *from your bookseller or* 13*s.* 6*d. post paid from us. U.S.A. and Canada* $3.00.

PERCIVAL MARSHALL
19-20 NOEL STREET, LONDON, W.1

...you can make it on a

Myford ML 7
3½-inch heavy duty lathe; 7-inch swing (10-inch in the gap) Bench or cabinet mounting.

A low-cost, accurate, metal-working lathe—with a large range of optional extras to extend its versatility.



Extra attachments and accessories include 3- and 4-jaw chucks, collets, fixed and travelling steadies, vertical slides, dividing heads, taper turning, circular saw table, etc. A quick-change gearbox is available.

Illustration includes Clutch, Motor and Thread Dial Indicator which are not Standard Equipment

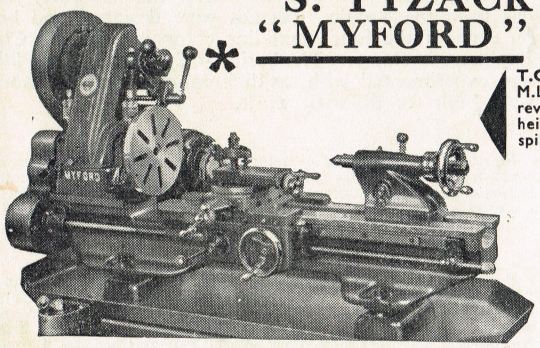
Please write for further information to:—

MYFORD MACHINE TOOLS

Myford LIMITED

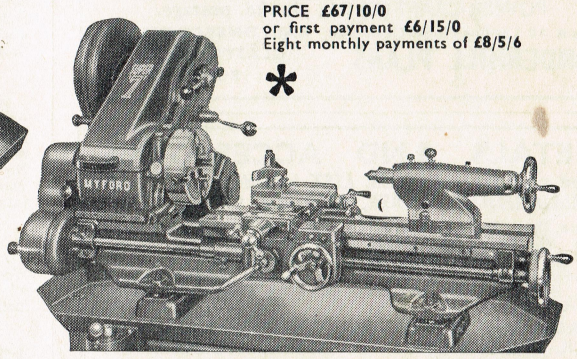
BEESTON NOTTINGHAM
TELEPHONE NOTTINGHAM 254222

S. TYZACK & SON LTD.
"MYFORD" LATHE SPECIALISTS



T.G.705. 3½" "Myford" Turning and Screw Cutting Lathe, heavy duty M.L.7, clean design, accurate limits, high tensile steel spindle, tumbler reverse, full compound sliderest, set over tailstock, mounted countershaft, height of centres 3½", distance between centres 20", swing in gap 10" six spindle speeds 35 to 640.
Complete with Standard equipment. Bench Model.

PRICE **£67/10/0**
or first payment **£6/15/0**
Eight monthly payments of **£8/5/6**



T.G.706. 3½" "Myford" Super Seven Turning and Screw Cutting Lathe, 14 spindle speeds 25 to 2,180 r.p.m., clutch countershaft control, full compound sliderest, extra long slides, extra long tailstock barrel, beautifully machined and finished, distance between centres 19", swing over bed 7".
Complete with Standard equipment

BENCH MODEL **£97/10/6**
or first payment of **£9/15/0**
Eight monthly payments **£11/19/1**

Illustrated literature of all "Myford" Lathes and accessories post free on request.

ONLY LONDON ADDRESS
S. TYZACK & SON LTD.
341-345 OLD ST., LONDON, E.C.1

TEL: SHOREDITCH 8301 TEN LINES